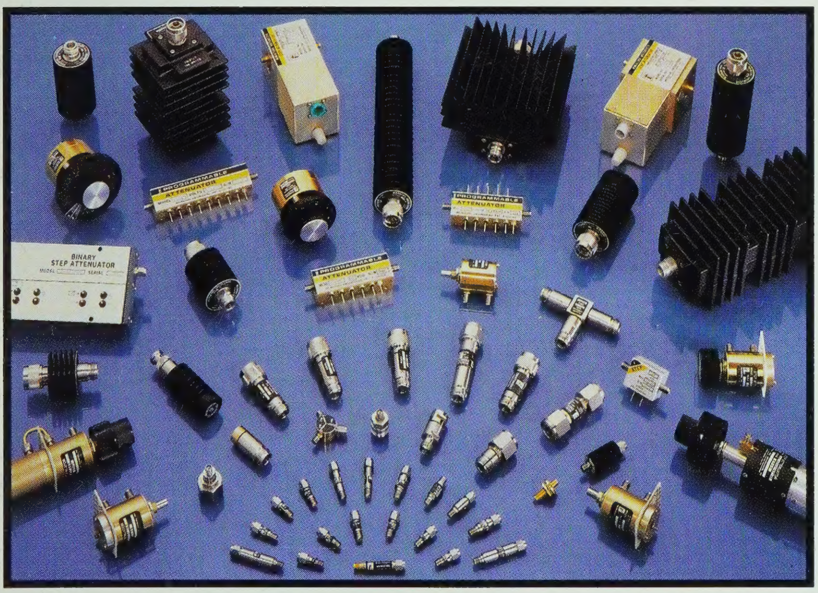
Lucas Weinschel

WEINSCHEL ENGINEERING
VM7 ATTENUATOR AND SIGNAL CALIBRATOR
Lucas Weinschel Inc
8552 FREQUENCY CONVERTER

Microwave & RF Components & Instruments Catalog

40
Lucas Weinschel
years
PRODUCTS
AND
SOLUTIONS


PROGRAMMABLE ATTENUATOR
BINARY STEP ATTENUATOR

Lucas Weinschel Inc

Lucas Aerospace

Communications & Electronics

HOW TO USE THIS CATALOG

- A **Quick Reference Product Guide** is provided on the title page of the catalog to give users a quick entry into specific product areas.
- A complete **Model Number Index** of all **Lucas Weinschel** products located within this catalog is provided on page iv.
- A page by page **Product Index** containing all products located within this catalog is provided on page vi.
- A general information page outlining general features and applications is provided at the beginning of each major product category throughout the catalog.
- A **Quick Reference Guide** with general product specifications at the beginning of each major product category is provided to help you quickly select the component that fits your needs.
- **Also:**

Products offered by other Lucas Aerospace Communications & Electronics Divisions can be found on pages 185-196.

An **Alphabetical Index** is provided on pages 199-200.

A list of **Lucas Weinschel** Sales Representatives is given on pages 197-198.

Warranty information can be located on rear cover.

Return Cards for ordering additional copies of this catalog or other Lucas Weinschel data are given inside the back cover.

Prices and Specifications are subject to change without notice.

Lucas Aerospace
Communications & Electronics

Microwave & RF Components & Instruments Catalog

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Lucas Weinschel, a division of
Lucas Aerospace Communications & Electronics Inc

ENGINEERING THE COMPONENTS OF EXCELLENCE

3rd Edition, 1993

ORDERING & SERVICE INFORMATION

HOW TO ORDER: Please order by both catalog model number and description of the component to avoid any misunderstanding (e.g., Model 1506A Broadband Coaxial Power Divider).

Special features and modifications not listed in the specifications may be available at extra cost. Please contact the factory, toll free, 800-638-2048 regarding any nonstandard features.

WHERE TO ORDER: Address all purchase orders and other communications to:

Lucas Weinschel
P.O. Box 6001
Gaithersburg, MD 20884-6001

or contact your nearest Lucas Weinschel Sales Representative. A complete list of our Sales Representatives is provided in the last section of this catalog.

Purchase orders will be accepted via phone, telex or fax pending confirmation of your standard purchase order form. Determination of prices, terms and conditions of sale and final acceptance of orders are made only at:

Lucas Weinschel
P.O. Box 6001
Gaithersburg, MD 20884-6001 USA

Phone #:	301-948-3434
Telex:	440702
Telefax:	(301) 948-3625
Toll Free:	800-638-2048
Express #:	800-542-4457

DOMESTIC TERMS: Formal price quotations remain in effect for 60 days. Terms of payment are net 30 days for established accounts. Terms for new accounts are also 30 days subject to approval of credit. If credit has not been established, payment must be received before shipment or shipment will be made C.O.D. to avoid delay. All prices are F.O.B. Gaithersburg, Maryland and include commercial inspection and packing for shipment within the continental United States.

EXPORT TERMS: Export prices including the cost of packing are available from Lucas Weinschel or from the export representatives listed on page 274. Payment terms are Cash-in-Advance or Irrevocable Letter of Credit payable through a US Bank against presentation of our draft and corresponding documents. All prices are F.O.B. Gaithersburg, Maryland.

MINIMUM BILLING: Purchase orders amounting to $250.00 net or less, will be billed at $250.00 plus shipping costs.

SOURCE INSPECTION SURCHARGE: If customer or Government Source inspection is required for components, add $100 or 2% of purchase order value, whichever is greater. For Instruments, add $200 or 2% of purchase order value, whichever is greater. Source inspection is limited to end items only.

WARRANTY: Refer to Lucas Weinschel's warranty on inside rear cover.

IN-WARRANTY REPAIR: An apparent malfunction of an instrument or component may be corrected over the phone by first contacting the local Lucas Weinschel representative or the Customer Service Department at the factory. Weinschel's representative will direct you to the nearest authorized service center. **DO NOT** send the instrument or component back to the factory without a Return Materials Authorization (RMA) Number from Lucas Weinschel. When it is necessary to return an item, state the symptoms, catalog and type number of the instrument or component, and date of original purchase. Also, your Company name, your name, and phone number should be written on a card and taped to the item returned. Be sure to include the Lucas Weinschel RMA number on all paper work including shipping documents.

OUT-OF-WARRANTY REPAIR: Should it become necessary to return an instrument or component for repair, follow the procedure described in the preceding paragraph prior to shipping. Within one week after receipt at the factory, the unit will be evaluated and a formal quotation will be supplied. Repair will begin when authorization is received in the form of a Purchase Order. Lucas Weinschel gives a 90-day warranty on all out-of-warranty repairs.

SHIPPING INSTRUCTIONS: Unless specific instructions accompany the order, we shall use our judgment as to the best method of shipment. Shipments can be made by either air or surface transportation. For fast delivery, air shipment is recommended and will be employed on request at a reasonable premium over other means.

SPECIFICATION CHANGES: We reserve the right to discontinue any item without notice and to change specifications (without notice) at any time without incurring any obligation to incorporate new features into instruments or parts previously sold.

PARTS: When ordering repair parts, please specify the part number and description of the item as well as the type number and serial number of the instrument in which it is used.

CANCELLATION AND RETURNS: Orders placed with Lucas Weinschel may be cancelled only after authorization by Lucas Weinschel. Any authorized cancellation is subject to cancellation charges as determined by Lucas Weinschel. An instrument or component returned for credit will be subject to a restocking charge. If more than 6 months has elapsed since original purchase, the item may not be accepted for credit. Nonstandard instruments and components cannot be returned for credit.

Announcing !!!

EXPRESS
(800) 542-4457

Overnight Shipment

Lucas Weinschel now offers the fastest way for you to acquire components for your application or production use. Throughout this catalog you will find specific model numbers that are followed by: EXPRESS 800-542-4457 This symbol identifies those products that can be shipped to you from our plant within 24 hours of placing the order. The *Express* also extends its services to other products that may be available in stock at time of order. As with any quick-ship service, some restrictions apply:

ORDERING: Phone our Toll-Free *Express* Number **1-800-542-4457**. Our sales representatives will take orders between the hours of 8:30 am and 5:00 pm Eastern Time. You will receive immediate confirmation of the product availability, pricing and delivery information.

MINIMUM ORDER, CREDIT TERMS: If ordering an *Express* product, the minimum order is $50.* Prices will be confirmed over the phone at the time of your order. You can pay for your *Express* order in one of three ways.

1. Your: MasterCard VISA.

2. C.O.D. when supported by a purchase order number or authorization number.

3. Lucas Weinschel approved credit (with purchase order number). Most accounts can be approved instantly for amounts up to $2,000. PAYMENT TERMS ARE NET 30 DAYS.

DELIVERY SERVICES: Lucas Weinschel *Express* offers you the choice of any current delivery service offered by UPS** or Federal Express.** The charges for using these services will be added to your account. Remember that if you order an *Express* product and it does not leave the plant within 24 hours or less of order placement, the shipping cost is on us. The 24-hour guarantee applies only to full work days from receipt of order; weekends and holidays are excluded.

PRODUCT AVAILABILITY: This offer is limited to small quantities of less than 20 per product. If a larger quantity of a product is desired, consult the sales representative for delivery and quantity discounts. Should you require *Express* delivery of any product not included in the *Express* service, please ask our sales representative for availability and price.

For more information or a copy of our quick-reference catalog of all components offered by the *Express*, contact the Sales Department at Lucas Weinschel by calling (301) 948-3434 or (800) 638-2048, or by FAX (301) 948-3625.

NOTE: ***Express*** Delivery services are limited to US & Canadian customers. International customers please contact your local sales representative or Lucas Weinschel for the quickest available delivery.

* Including shipping cost.

** Delivery services are subject to change without notice. Carrier depends upon availablity of services offered. All rates based on current carrier charges and subject to change without notice.

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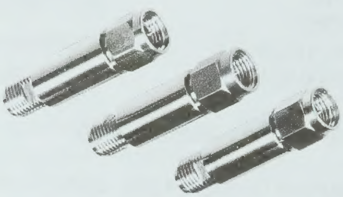
NEW PRODUCTS

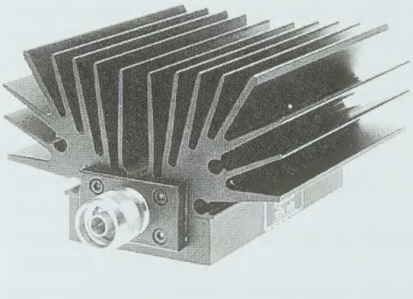
For more information about any of these New Products contact the Sales Department at Lucas Weinschel or your Local Representative..

Model 56
Fixed Coaxial Attenuators



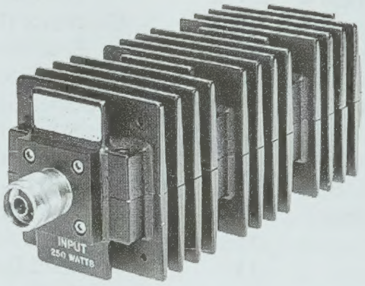
* dc to 26.5 GHz.
* 2 W avg, 500 W peak.
* Available in 3, 6, 10, 20, 30 dB.
* Low SWR: 1.10-1.25
* Flat Response: ± 0.5 dB.
* Precision 3.5 mm Connectors.
* Calibrated Sets also available (Model AS-20).

Model 1432
High Power Terminating Load



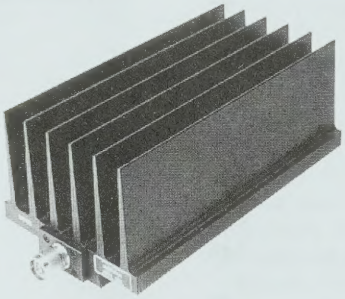
* dc to 8.5 GHz.
* 150 W avg, 5 kW peak.
* 1.30 Maximum SWR
* Operates down to dc.
* Flexible Mounting Position.
* Rugged Construction.
* Choice of Male/Female Type N Connector.

Model 1433
High Power Terminating Load



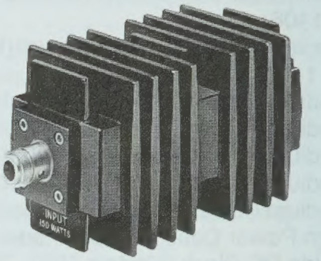
* dc to 5.0 GHz.
* 250 W avg, 10 kW peak.
* Low SWR: 1.10
* Operates down to dc.
* Rugged Construction.
* Lowest Size/Power Ratio.
* Choice of Male/Female Type N Connector.

Model 1434
High Power Terminating Load



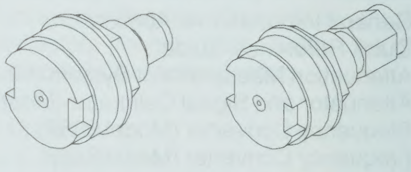
* dc to 2.5 GHz.
* 500 W avg, 10 kW peak.
* Low SWR: 1.10
* Operates down to dc.
* Rugged Construction.
* Lowest Size/Power Ratio.
* Choice of Male/Female Type N Connector.

Model 1435
High Power Terminating Load

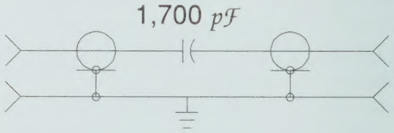


* dc to 5.0 GHz.
* 150 W avg, 10 kW peak.
* Low SWR: 1.10
* Operates down to dc.
* Rugged Construction.
* Choice of Male/Female Type N Connector.

Model 7010
PLANAR BULKHEAD with Inside DC Block



* Usable to 40 GHz.
* 2.92 mm Connectors to Planar Interface.
* Eliminates the requirement for a separate dc Block to protect instrument front ends.
* Offers multiple connector options and quick replacement of damaged connectors.
* Provides all the features and versatility of the PLANAR CROWN™ Connector System.



Communications & Electronics Inc

Lucas Aerospace has developed a formidable technical Company (Lucas Aerospace Communication & Electronics Inc) by carefully selecting and combining various synergistic technologies. The formation of **Lucas Aerospace Communications & Electronics Inc** enables Lucas Aerospace to effectively design and manufacture major subsystems and system components for applications in the defense and commercial/industrial markets both domestically and internationally. This Company represents a broad spectrum of expertise which is geared to serve the present and future needs of its customers. The Lucas Aerospace Communications & Electronics operations include:

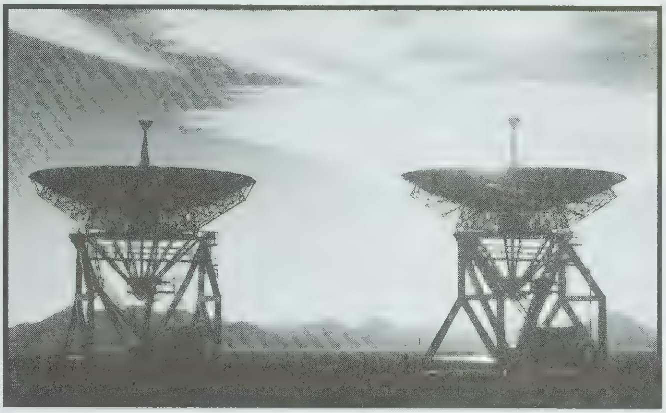
Lucas Aul: Lucas Aul has value engineered and manufactured a wide range of specialized electronics from rigorous customer requirements. Before a product is manufactured, Lucas Aul engineers verify conformance to customer drawings and specifications. In many cases value added proposals are generated to provide the customer with product improvements, greater production efficiency and lower cost. Other Lucas Aul capabilities include:

* Quality Control MIL-Q-9858 and MIL-I-45208.
* Automated Component Insertion Systems and Microprocessor-Controlled Soldering Equipment.
* Conformance to WS-6536, MIL-STD-2000 and MIL-S-45743 Soldering Specifications.
* Computer-Controlled Functional Burn-In, ESS, and Environmental Testing.

Lucas Epsco: Comprehensive facilities allow Lucas Epsco to design and manufacture microwave components, subsystems and systems for its government, military, and commercial/Industrial customers in both domestic and international markets. Lucas Epsco's product line includes:

* High Power, Narrow Band, GaAs FET Amplifiers and subsystems at frequencies from 2.5 to 18 GHz.
* Custom Microwave Waveguide and Coaxial Components/Subsystems.
* High power CW and Pulsed Signal Sources.
* Satellite Communications Components and Systems.

Microwave Technologies: The Microwave Technologies Division specializes in the design and manufacture of custom GaAs FET, Hybrid Microwave Integrated Circuit (HMIC) amplifiers and amplifier based integrated subassemblies covering the frequency range of 0.1 to 40 GHz. MTD's products capabilities include:



* Broad and narrowband amplifiers (Low Noise to High Power).
* Waveguide and Coaxial Circulators and Isolators.

Lucas Weinschel: As a Leader in the microwave industry, Lucas Weinschel has always been devoted to the development and manufacture of the highest quality microwave components, precision microwave measurement and calibration instruments. Today, Lucas Weinschel products are employed in the standards laboratories, production areas and quality control departments of most electronic and aerospace companies as well as governmental agencies and other research firms throughout the world. Lucas Weinschel's current product line includes:

* Fixed and Variable Attenuators (High Power, Precision and Steps).
* Test Instruments and Calibration Standards (traceable to NIST).
* PLANAR CROWN™ Connector System.
* Terminations and Adapters.
* Programmable Attenuators and Controllers.
* Solid State Pin Attenuators and Phase Shifters.
* Custom Products.

Lucas Zeta: Lucas Zeta has provided its domestic and international customers with custom engineering and design of systems and subsystems to meet the most stringent military and government requirements. Lucas Zeta's product line operates in the 0.01 to 20 GHz frequency range and includes:

* Microwave Frequency Sources and Subsystems.
* Communications Signal Intercept Equipment.
* High Power RF Amplification for Communications and EW Systems.

Lucas Epsco

Lucas Epsco Inc. is unique in the Microwave industry in having developed a single source capability for a vast array of products spanning a broad spectrum of frequencies from 50 MHz to 50 GHz at power levels from 1 watt to 100,000 watts. For over three decades the technologies and skills that are the very foundation of Lucas Epsco have resulted in a long list of leading-edge products and have earned the Company a reputation as a state-of-the-art supplier and a position among the industry leaders. Lucas Epsco's ability to integrate skills in microelectronics, waveguide and coaxial designs, antennas and other advanced technologies, a thorough understanding of their application and an unyielding dedication to product quality have and will continue to be vital ingredients in satisfying the ever demanding needs of our customers.

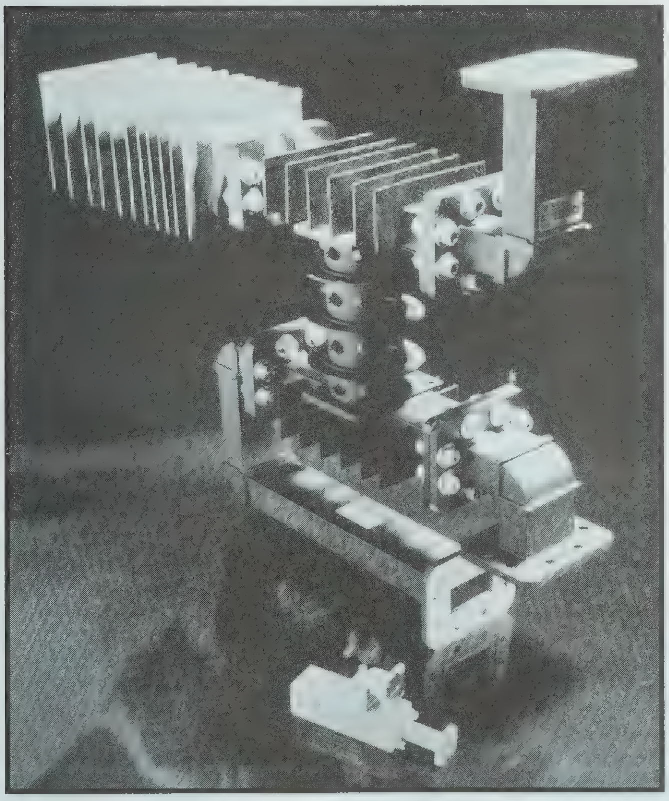
Lucas Epsco designs and manufactures microwave components, subsystems and systems for its military and commercial/industrial customers in the domestic and international markets. These product areas include:

* High power, narrow-band, solid state amplifiers/subsystems and systems.
* Custom microwave waveguide and coaxial components/subsystems.
* High power CW and Pulse signal sources.
* Satellite communications components and systems.

Lucas Epsco utilizes its expertise in Gallium Arsenide technology in the design and manufacture of amplifiers and subsystems at frequencies from 2 GHz through Ku-Band and output power levels upwards of 1 watt. The Company has complete facilities for manufacturing its products using either packaged or chip semiconductors, hard or soft substrates, and hermetically sealed or vented packages, thus assuring its customers of application of the manufacturing technology appropriate to their application.

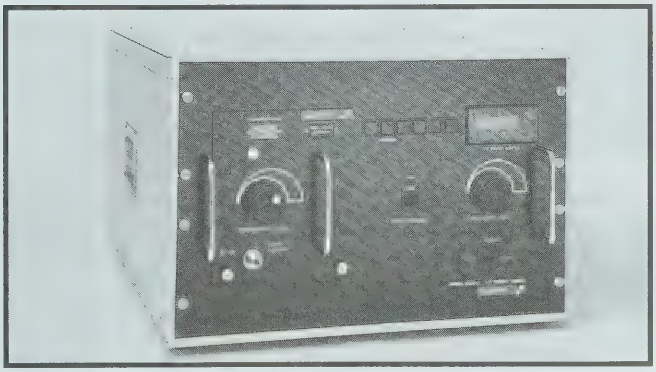
Lucas Epsco GaAs FET amplifiers are found in a vast variety of applications ranging from voice communication to data and video satellite communications to EW systems, radar and test and measurement systems. They have been designed to meet commercial specifications as well as demanding Military specifications.

Lucas Epsco also enjoys an enviable reputation as a supplier of custom waveguide and coaxial components and subassemblies. These products embody the latest technologies and highest levels of reliability and range in frequency from the VHF Band to the Millimeter Band, from operating power levels of only a few watts to subsystems handling well over 10,000 watts. These products find application in a wide variety of commercial and military systems including satellite communications earth stations, radar and EW systems.



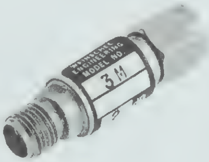
Lucas Epsco's broad capabilities in microelectronics, waveguide components, digital and analog circuit design and antenna design technologies have been synergistically applied in the design of VSAT (Very Small Aperture Terminals) subsystems and systems. In addition to the Ku-Band parabolic, offset fed antennas furnished with VSAT systems, Lucas Epsco serves other markets with a line of satellite antennas ranging in size from 0.85 to 2.4 meters. A variety of mounts and feedhorns are also available for various applications.

Lucas Epsco has been long established as the leading industry supplier of high power CW and Pulse signal sources. These instruments employ unique technologies and rare manufacturing skills which have been maintained and refined over the years. The CW unit, producing up to 250 watts of power, covers the range from 50 to 2000 MHz. Two standard Pulse sources are capable of 5 and 40 KW of output power.



Lucas Weinschel

As a leader in the microwave industry, Lucas Weinschel has always been devoted to the development and manufacture of the highest quality microwave components and precision microwave measurement and calibration instruments.



Weinschel was the first to design and manufacture commercial RF coaxial attenuators in 1948. Today, we offer the most comprehensive line of high quality RF and microwave products in the dc to 40 GHz frequency range. These products are employed in the standards laboratories, OEM, and quality control departments of most electronic and aerospace companies as well as governmental agencies and private research firms throughout the world. These products are found in numerous applications such as: satellite and surface communication, electronic warfare, missile guidance, electronic countermeasures, navigation, radar, OEM, signal analysis, telecommunications, air traffic control telemetry and precision microwave related instruments and system use. Lucas Weinschel is a name acknowledged to be synonymous with reliability, quality, technical competence and leadership in state-of-the-art microwave measurements of high accuracy. Our current product lines include:

- Fixed and Variable Attenuators (High Power, Precision and Steps)
- Test Instruments and Calibration Standards (traceable to NIST)
- Microwave Integrated Circuit (MIC) Design
- PLANAR CROWN ™ Connector Systems
- Programmable Attenuators
- Power Splitters and Dividers
- Terminations and Adapters
- Custom Products

Lucas Weinschel, a division of Lucas Aerospace Communications & Electronics Inc. is located on 19 acres near the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. A 50,000 square foot engineering and manufacturing facility is fully equipped to satisfy most customer requirements either for our standard products or engineering and design of those custom products for special applications.

All products manufactured by Lucas Weinschel are the result of a careful blending of competent design, precision machining, skilled technicians, proven manufacturing techniques and rigid quality assurance. Besides providing high quality microwave components and Instruments to our customers, Lucas Weinschel offers a number of other in-house capabilities and services:

Manufacturing Engineering: This group of skilled personnel specializes in value engineering, design reviews, process control documentation, and acceptance test procedure (ATP's) development to customer and MIL-SPEC requirements.

Manufacturing Engineering also provides extensive assistance to customers, production and various departments in monitoring resistor (thick and thin film) development/fabrication, dicing, Hi-Rel production, E.P.A./hazardous materials, stress screening, reverse engineering capabilities, environmental testing, and MIL-A-3933E qualification. Environmental testing includes: salt spray, vibration/shock, burn-in, hot and cold environmental chambers, humidity testing, life cycle testing, in accordance with portions of MIL-STD-202.

Custom Products: Customized products have been a large part of Lucas Weinschel's business for over 38 years. The majority of these customized products produced at Lucas Weinschel are the result of adapting a standard or generic product to specific customer needs or requirements. This process provides our customers with reliable, quality products at low competitive prices to meet those just-in-time deliveries. Our experienced group of engineers is fully capable of designing and delivering products that will satisfy most customer requirements.

EXPRESS
800-542-4457
Overnight Shipment

Microwave Integrated Circuit (MIC) Design: The Lucas Weinschel MIC LAB can produce prototype and limited production of high and low frequency microwave devices to specific customer requirements. Lucas Weinschel designs and creates all necessary master artworks to be used in the production of these devices. In-house capabilities include photo reduction, imaging, and the etching of our specially designed circuits. Lucas Weinschel can also provide customer defined packaging and testing requirements. Other capabilities include:

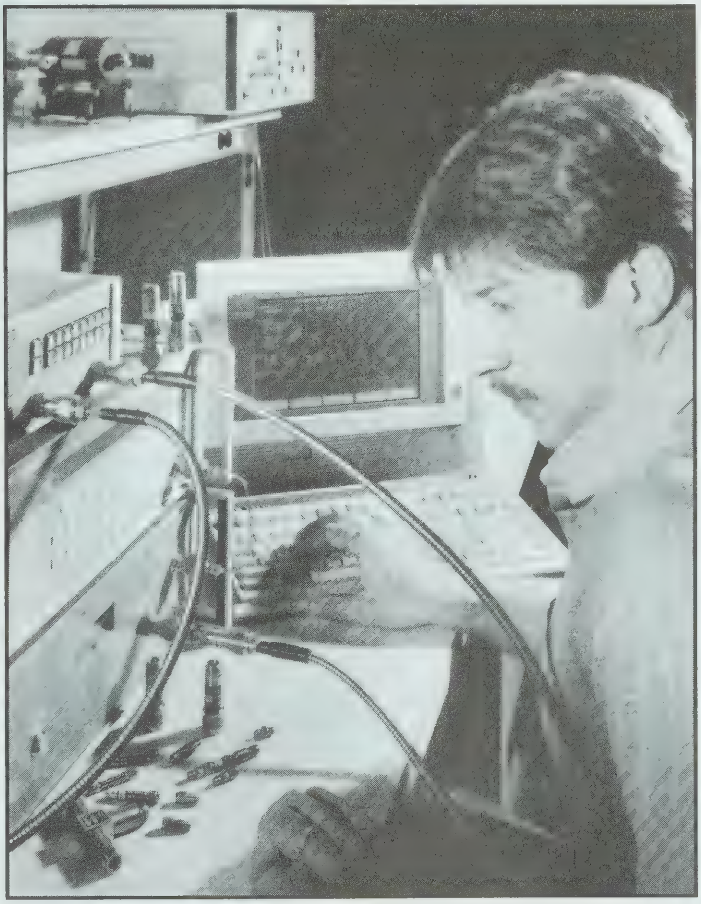
- Precision Artwork Generation and Precision photo lithography
- Precision Etching (Hard and Soft Substrates)
- Thermocompression Bonding (Wire and Ribbon)
- Ultrasonic Thermocompression Bonding (Wire and Ribbon)
- Solid State Pin Attenuators, Switches and Phase Shifters, and other Custom Products

Precision Machining and Sheet Metal Fabrication (with Model Shop): Our advanced precision machining and custom sheet metal fabrication services produce the necessary components from raw material for production and prototype requirements within Lucas Weinschel as well as projects for a diverse customer base. This is accomplished by a team of highly skilled craftsmen using state-of-the-art equipment. Our team is dedicated to close tolerance machining and fabrication with "just-in-time deliveries," fast turnaround, working to customer's drawings or sketches while meeting the requirements of MIL-I-45208A.

Product Design and Drafting: Design and drafting are performed on computer aided design (CAD) systems. Designers utilize software packages such as CADKEY for mechanical design and drafting; Pads PCB for printed circuit board layout; and Pads Logic for schematic capture.

Test and Service: Lucas Weinschel is committed to providing fast, professional customer service and support world wide. You have the assurance of knowing that a staff of highly trained professionals is available using approved procedures and instrumentation. The Lucas Weinschel Test and Service Department is always committed to quality as defined by the customer. MIL-45662 qualified Metrology and Calibration Laboratory with GIDEP and NCLS affiliations.

***Express* Shipment Service:** Lucas Weinschel's *Express* Shipment Service offers the fastest way for our customers to acquire selected off-the-shelf components for their application or production use. A large inventory of standard products allows Lucas Weinschel to guarantee that a customer's *Express* order will be shipped from our plant within 24 hours of placing the order or we will pay the shipping. The *Express* also extends its services to other products that may be available in stock at time of order.



With over 40 years experience as a leader in the microwave industry, Lucas Weinschel Inc is able to respond to unique customer requirements with reliable, high quality, cost effective products.

ENGINEERING THE COMPONENTS OF EXCELLENCE

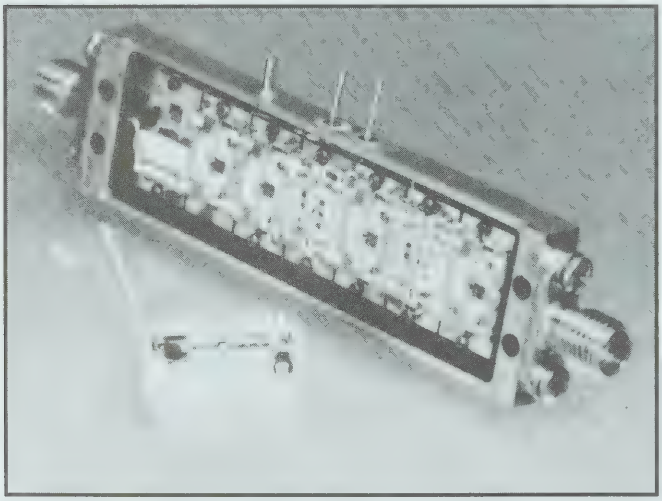
Microwave Technologies

The Microwave Technologies Division specializes in the design and manufacture of high quality microwave components for military and commercial markets. It's main product line includes GaAs FET Hybrid Microwave Integrated Circuit (HMIC) amplifiers, from low noise to high power types, amplifier based integrated subassemblies (super components), as well as thin film manufacturing services. Microwave Technologies is also a leading supplier of waveguide and coaxial circulators and isolators for terrestrial communications and earth terminal applications.

Microwave Technologies, a division of Lucas Aerospace Communications & Electronics Inc is located in suburban Toronto, Canada.

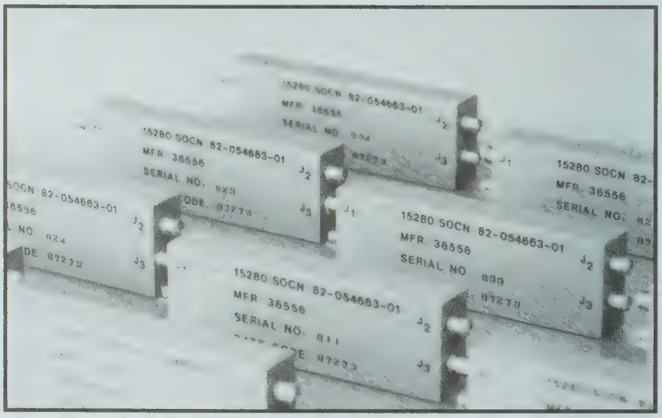
The Microwave Technologies Division has combined its engineering and manufacturing resources to offer an integrated development and manufacturing capability. Systems expertise in programs that require the integration of microwave components with dc, control, logic, and signal processing functions is provided, using a wide range of implementation technologies.

GaAs FET INTEGRATED SUBASSEMBLIES AND AMPLIFIERS:



- 0.1-40 GHz Defense Products Manufactured Under Quality Program MIL-Q-9858A or AQAP-1
- QUASI-MMIC Advanced Manufacturing Technology
  - Batch Processing for Volume Hybrid MIC Applications
  - Resistor and Capacitor Deposition
  - Solid and Plated Via Holes
  - Air Bridges and Spiral Inductors

- Proven Product Capabilities:
  - Fast Response Gated Pulse Amplification
  - TTL Control of System Functions
  - Limiting
  - Modulation
  - Bite Options
  - Variable Gain
  - Filtering
  - Frequency Conversion
  - Switching
- Commercial Amplifier Products incorporating Hybrid MIC and Packaged Technologies for optimum trade-offs.
- TELECOM and SATCOM Solid State Power Amplifiers
- Low Noise Amplifiers with superior noise figures and performance.
- Up/Down Conversion Subsystems



THIN FILM FABRICATION SERVICES:

* Sputtered Deposition of:

- Gold
- Titanium Tungsten
- Tantalum Nitride

* Electro Deposition of

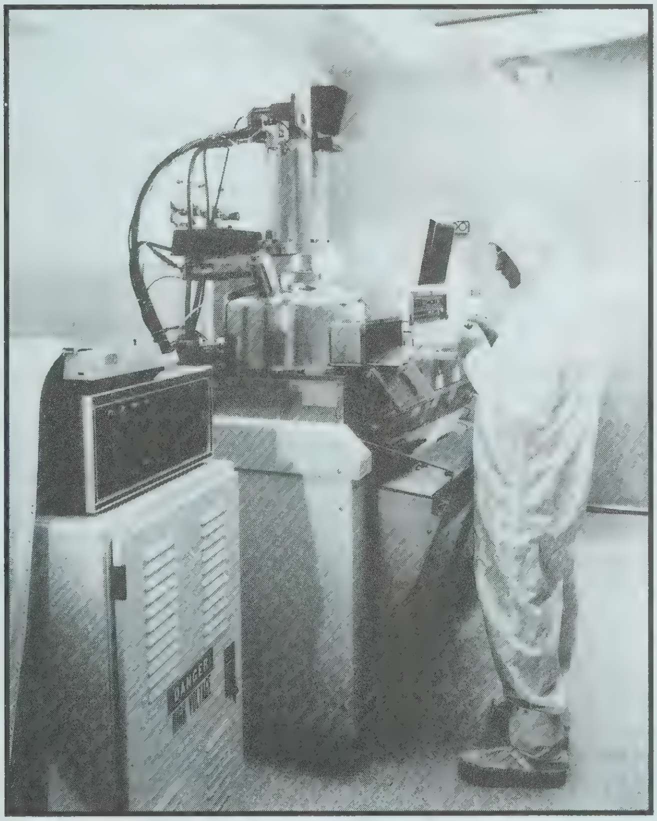
- Gold
- Nickel
- Copper

* Chemical Vapor Deposition of:

- Silicon Nitride
- Silicon Oxynitride
- Silicon Dioxide

* Substrate Materials Processed Include:

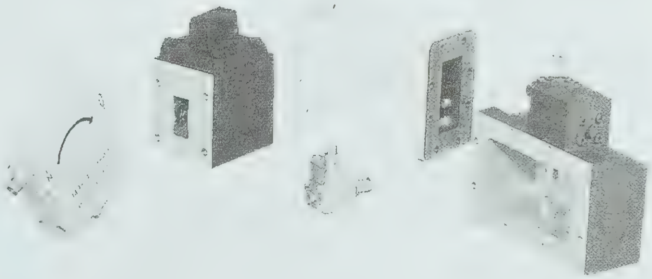
- Silicon
- Alumina (as Fired or Polished)
- Ferrites
- Quartz
- Glass
- Titanates



* Hybrid MIC Realized with a Seven Layer QUASI-MMIC Process Incorporating:

- Air Bridges
- Solid and Plated via Holes
- Resistors
- Capacitors
- Spiral Inductors

* Precision Dicing of Substrates.



FERRITE JUNCTION DEVICES AND PASSIVE ASSEMBLIES:

* Coaxial and Waveguide Ferrite Junctions with Production Structured and Tooling Designed for High Volume Fast Response Telecom Requirements

* Electroformed Structures Up To One Meter

* Integrated Passive Assemblies

Lucas Zeta

Since its founding in 1968, **Lucas Zeta** has been noted as an engineering-based, systems oriented manufacturing company. We design and produce advanced electronics systems, subsystems, and components for the defense, aerospace and communications industries. The company's products are used in systems such as weapons guidance, radar, missiles, jammers, receivers, data links, and in test and simulation equipment used to calibrate and monitor these systems. Today, sophisticated Lucas Zeta products serve in a variety of critical and hostile environments including satellites; space and re-entry vehicles; shipboard, land and airborne military systems; and advanced communications and direction finding systems.

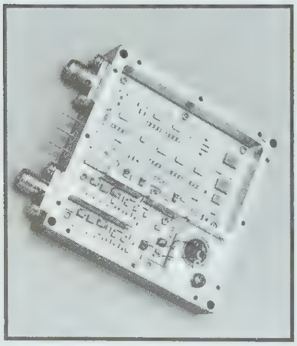
Lucas Zeta, a division of Lucas Aerospace Communications & Electronics Inc. is located in San Jose, California, in the heart of Silicon Valley, just 10 minutes from the San Jose Airport and only 40 minutes from San Francisco. Our modern new facility is fully equipped for the development and production of MIL-Qualified microwave and RF components and subsystems.

Business Areas: Lucas Zeta serves its domestic and international military-industrial customers in three distinct business areas:

- Microwave Frequency Sources, Subsystems
- Communications Signal Intercept, Location and Jamming Systems
- High Power RF Amplification for Communications and EW Systems

Microwave Frequency Sources and Subsystems:

Lucas Zeta is known for its outstanding microwave design capability and has a strong technical team with the experience required for the in-depth understanding needed to provide excellent quality and performance. In addition to component and subsystem design expertise, the staff is well versed in systems design trade-offs. Lucas Zeta's unique ability to combine both analog and digital expertise, with advance microwave and MIC technology, enables us to address difficult technical requirements resulting in optimum designs and cost effective solutions to our customers' microwave and communications systems needs.



Lucas Zeta's designs feature key performance parameters, such as frequency agility, accuracy and stability with associated signal purity. Our microwave products typically fall within the 10 MHz to 20 GHz frequency range and include:

- Multipliers
- Stable Crystal Oscillators
- DRO's
- Limiting Amps
- Comb Generators
- Up/Down Converters
- Microwave Subsystems

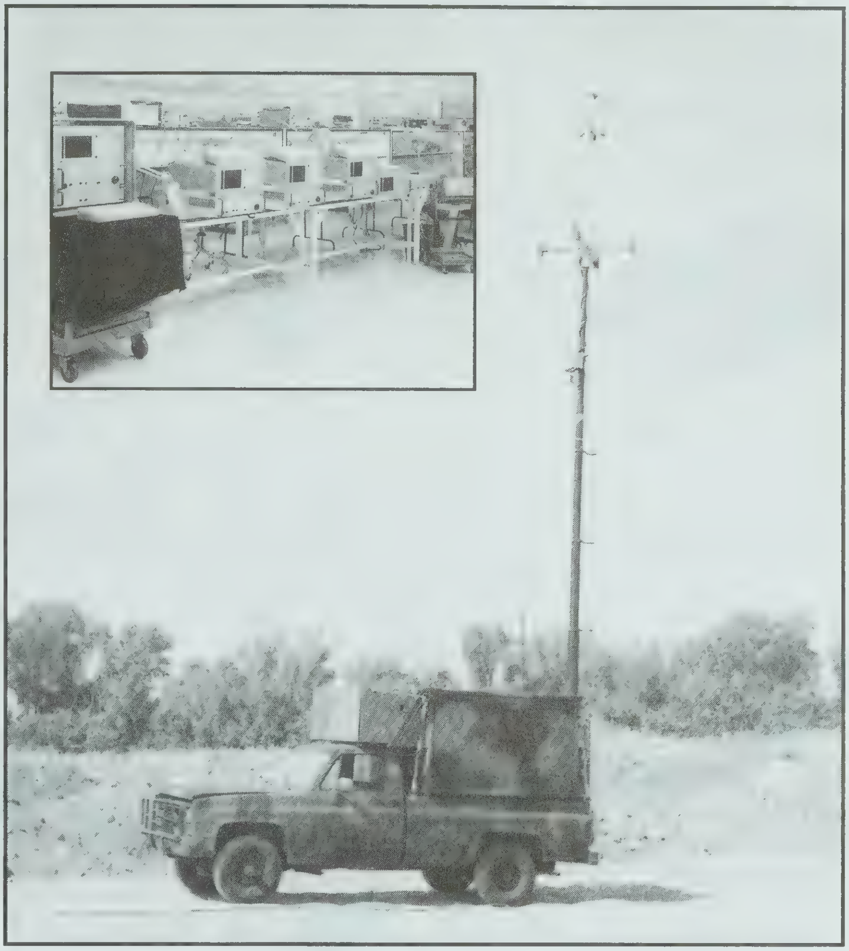
Lucas Zeta's microwave products are currently deployed in the following typical military and space applications:

- F14, F16, B1B, MRCA, Rover Joint Aircraft
- Patriot, Phalanx, Aegis, Watchman, Rasit-B Radars
- Sparrow, Phoenix, Roland, Standard Missiles
- SLQ-32, SLQ-17, ALQ-131, TRC-170, TRN-45 Systems
- TDF-1/TV-SAT, GEOSAT, TOPEX, SIRIO Satellites
- Space Shuttle Landing Systems

Communications Intercept Location and Jamming Systems:

Lucas Zeta has extensive capability and in-depth experience in signal intelligence collection and analysis. Lucas Zeta's communication signal and intercept, direction finding (DF) and emitter location systems are in service with military and government agencies both in the United States and overseas.

Lucas Zeta's ZS-1000 series intercept and DF Systems cover a wide variety of mission requirements in the HF and V/UHF frequency spectrum. All systems are designed utilizing an advanced software approach to signal collection, using proven, widely accepted computer hardware and software based upon cost effective IBM-PC technology.



A variety of ZS-1000 series systems are available in the HF through UHF frequency spectrum to fulfill specific mission requirements including fixed-site, ground mobile, shipboard, airborne and man-portable. Lucas Zeta's communications systems are utilized in the following major system applications:

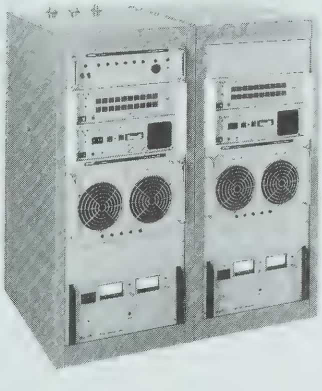
- AN/FSQ-144 Trojan Program
- WSMR Range Monitoring System
- National Monitoring System
- Electronic Combat Systems

High Power RF Systems, Subsystems and Modules:

Lucas Zeta designs and produces solid state High Power Amplifier (HPA) systems and subsystems that provide output RF power levels up to 1000 Watts CW in a line of broadband standard products. In addition, output RF power levels up to 10,000 Watts CW are available in custom designs.

The Lucas Zeta HPA's rugged designs enable them to withstand demanding environments such as those encountered in mobile shelter applications and airborne rack applications for use as ECM-Jammers or high power communications amplifiers. Lucas Zeta's HPA's are also ideally suited for precision laboratory applications such as EMI testing, field testing, and the testing of sophisticated components and systems where power stability, output power flatness and precision power control are required. Lucas Zeta HPA's and associated modules are utilized in the following major system applications:

ALQ-99
GPS
Faker
Aegis
Brass Ring
ALT-41
Mutes
ALT-42
JTIDS
Comfy Sword
Patriot
Octagon



Lucas Zeta's standard line of miniature RF silicon power amplifier modules combine wide bandwidth, high gain and high power in very compact housings. Available in a range of frequencies from 1.0 MHz to 1.0 GHz, these state of the art designs utilize the latest in silicon FET technology.

In addition to the standard models, Lucas Zeta can provide custom modules incorporating broadband, high power in miniature housings which integrate additional system functions such as output filtering, ALC amplitude modulation, T/R switching and over temperature protection.

This miniature series of RF power amplifier modules can be furnished to meet either commercial or MIL specifications PA modules that operate at frequencies up to 2.0 GHz with various gain and output power levels are available as either "off the shelf" designs or custom designs.

Division Locations

Microwave Technologies
3135 Universal Drive,
Mississauga, Ontario, Canada
TEL: (416) 625-4605
TELEFAX: (416) 625-4274

Lucas Epsco
99 South Street
Hopkinton, Mass. 01748
TEL: (508) 435-2400
TELEFAX: (508) 435-2022

Lucas AUL
1055 Stewart Ave.
Garden City, NY 11530
TEL: (516) 222-6000
TELEFAX: (516) 222-1325

Lucas Zeta
2811 Orchard Parkway
San Jose, California 95134
TEL: (408) 434-3600
TELEFAX: (408) 433-0205

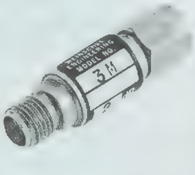
Lucas Weinschel
P. O. Box 6001
Gaithersburg, Maryland 20884-6001
TEL: (301) 948-3434, **800-638-2848**
Express #: **800-542-4457**
TELEFAX: 301-948-3625,
TLX: 440702

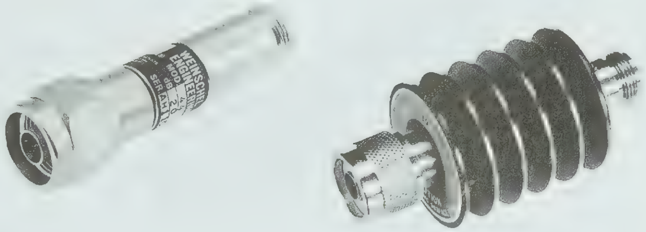
Fixed Attenuators

GENERAL INFORMATION

Lucas Weinschel's comprehensive fixed attenuator line offers our users a number of features, such as:

- **MIL-A-3933 Qualified Attenuators.**
- **Miniature Size and Light Weight** - Lucas Weinschel miniature attenuators are unmatched for power capability and high ambient temperature operation.
- **Uniform Phase Characteristics** - Excellent phase linearity with frequency, and typical unit-to-unit tracking.
- **Rugged Construction** - Designed to meet most environmental requirements of MIL-A-3933.
- **Quality Connectors** - Lucas Weinschel SMA, Type N, TNC, and 2.92mm connectors are superior connectors which mate nondestructively with connectors per MIL-C-39012. Precision GPC-7 connectors per IEEE-STD-287.
- **Stability** - Low temperature and power coefficients. Lucas Weinschel's film resistors are artificially aged for high stability under normal as well as extreme operating conditions.
- **Wide Choice of Attenuation Values** - Standard values from 0 to 60 dB.
- **Low, Medium, and High Power Models** - Lucas Weinschel offers Attenuator Models from 2 to 500 Watts (average) and 0.25 to 10 kilowatts (peak).
- **Broadband Frequency Range** - Lucas Weinschel Attenuators offer a wide selection of frequency ranges from dc to 40 GHz.
- **High Reliability Models Available** - Most Lucas Weinschel Fixed Attenuators can be supplied according to customer specified testing, environmental or military or government specification requirements.
- **Custom Designs Available on Request.**





In this section of the catalog, each Fixed Attenuator is outlined utilizing individual data sheets containing product features, specifications, and outline drawings. These data sheets are preceded by a **quick reference guide** to help you quickly select the attenuator or attenuators that fit your needs. The page number for each attenuator data sheet is given in the quick reference guide (next page).

APPLICATIONS

Lucas Weinschel Attenuators are used in a wide variety of applications in the electronic field for the control or measurement of radio frequency energy. Attenuators are used as accurate standards in the measurement of loss or gain by the RF substitution method. They are used as a means of extending the dynamic range of measuring equipment such as power meters, field intensity meters, spectrum analyzers, and amplifiers, or to prevent overloading of receivers and amplifiers. They also reduce, by masking, the effects of variable or mismatched impedances on such circuit elements as oscillators, T-junctions, mixers, etc.

Fixed Attenuators can satisfy almost any requirement involving a reduction in power. Lucas Weinschel designed and manufactured attenuators remain precision calibrated over wide ranges of humidity, temperature, and other ambient conditions for long periods of time.

All our attenuators have maximum average and peak pulse input power limits. The average power limit decreases linearly as the ambient temperature increases. If these limits are exceeded, burnout of the attenuator element results or its calibration may be permanently changed. When used within its specifications, an attenuator is an indispensable component in measurement and system applications.

Fixed Attenuators dc-40 GHz, 2-500 Watts Quick-Reference Guide:

Model Number	Connector Type	Range (GHz)	Power (Watts)	Power (kW)	Attenuation Value (dB)	SWR*	Page No.
3330/3331	SMA	dc-18	2	0.25	1 thru 30	1.20-1.50	14
4H	SMA	dc-18.6	2	0.25	1 thru 10, 20, 30	1.15-1.35	15
• 3M/3T	SMA	dc-12.4	2	0.5	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25	16
• 4M/4T	SMA	dc-18.0	2	0.5	1 thru 10, 20, 30, 40, 50, 60	1.15-1.35	17
9	SMA	dc-26.5	2	0.5	3, 6, 10, 20, 30	1.10-1.60	18
54	SMA	dc-40.0	2	0.5	3, 6, 10, 20, 30	1.35-1.60	19
• 55	TNC	dc-18.0	5	1	1 thru 10, 20, 30	1.15-1.35	20
55P	TNC/SMA	dc-18.0	5	1	1 thru 10, 20, 30	1.15-1.35	20
• 1	N	dc-12.4	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25	21
• 2	N	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.35	21
• 44	N	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25	22
17	GPC-7	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.10-1.20	23
• 18B	BNC	dc-12.4	5	1	1 thru 10, 20, 30	1.25-1.35	24
18T	TNC	dc-15.0	5	1	1 thru 10, 20, 30	1.25-1.40	24
• 41	SMA	dc-18.0	10	1	1, 2, 3, 6, 10, 20, 30	1.20-1.35	25
• 23	N	dc-18.0	10	1	1 2, 3, 6,10, 20, 30, 40, 50, 60	1.15-1.35	26
33	N	dc-8.0	25	5	3, 6, 10, 20, 30	1.20-1.30	27
• 24	SMA/N TNC/GPC-7	dc-8.0	50	5	3, 6, 10, 20, 30	1.20-1.30	28
• 46	N	dc-18.0	25	0.2	3, 6, 10, 20, 30, 40	1.20-1.35	29
• 47	N	dc-18.0	50	0.5	10, 20, 30, 40	1.20-1.35	30
• 48	N	dc-18.0	100	1	20, 30, 40	1.25-1.45	31
40	N	dc-1.5	150	10	3, 6, 10, 20, 30, 40	1.10	32
45	N	dc-1.5	250	10	3, 6, 10, 20, 30, 40	1.10	33
49	N	dc-8.0	150	5	3, 6, 10, 20, 30, 40	1.25-1.35	34
53	N	dc-2.5	500	10	20, 30, 40	1.10	35

• *EXPRESS* SHIPMENT AVAILABLE
* VARIES WITH FREQUENCY

MILITARY QUALIFIED ATTENUATORS

dc to 18.0 GHz

2 to 25 WATTS

MIL-A-3933, CLASS III/IV, N/S

FEATURES

- Screened and Non-screened models available.
- Choice of attenuation values from 0 to 40 dB.
- Frequency Ranges from dc to 18 GHz.
- Power capability from 2 to 25 watts.
- Test Data supplied per MIL-A-3933.

dB
DC-12.4GHz
2 WATTS
CLASS III
M3933/18
DC-12.4GHz
2 WATTS
CLASS III
M3933/14

MIL-A-3933 Basic Information

Military Part Number	Description *	Outline Drawing/ Dimensions
M3933/10	dc to 18 GHz 25 Watts Average; 2 kW peak	Refer to Lucas Weinschel Standard Model 46.
M3933/14	dc to 12.4 GHz 2 watts Average; 200 W peak	Refer to Lucas Weinschel Standard Model 3M.
M3933/16	dc to 18 GHz 2 watts Average; 500 W peak	Refer to Lucas Weinschel Standard Model 4M.
M3933/17	dc to 18 GHz 2 watts Average; 500 W peak	Refer to Lucas Weinschel Standard Model 55.
M3933/18	dc to 12.4 GHz 5 watts Average; 1 kW peak	Refer to Lucas Weinschel Standard Model 1.
M3933/25	dc to 18.0 GHz 2 watts Average; 500 W peak	Refer to Lucas Weinschel Standard Model 3T/4T.

* For complete specifications and ordering information refer to Military Specification, MIL-A-3933.

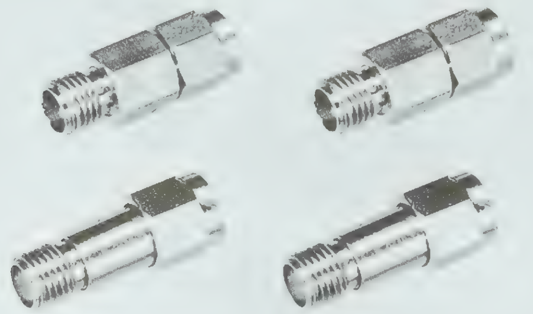
Models 3330, 3331

GENERAL PURPOSE ATTENUATORS

dc to 18.0 GHz

2 WATTS

Low Cost Subminiature



FEATURES

- **Low Cost** - These general purpose attenuators offer subminiature size, broadband frequency response, and attenuation values from 1 to 30 dB at low, competitive prices.
- **Two Configurations** - Round body Model 3330 and a hex body Model 3331.
- **Ideal for those Bulk Quantity Requirements.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

ATTN NOM (dB)	DEVIATION dc-12.4 GHz	 12.4-18 GHz
1 - 10	± 0.4	± 0.6
11 - 30	± 0.5	± 0.7

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.20
4 - 12.4	1.40
12.4 - 18	1.50

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watts @ 125 °C. 250 watts **peak** (5 µsec pulse width; 0.4% duty cycle).

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: No test data available.

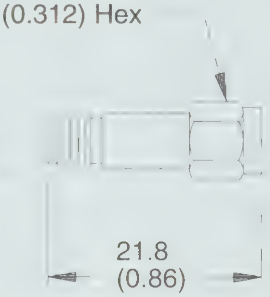
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

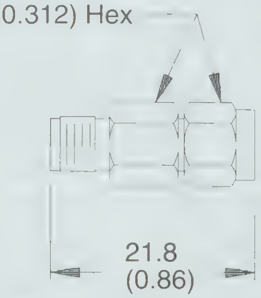
WEIGHT: 5 g (0.18 oz) maximum (Both Models)

PHYSICAL DIMENSIONS:

Model 3330
(round body)



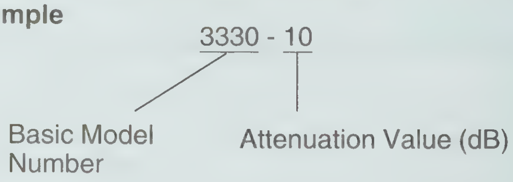
Model 3331
(hex body)



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example



Lucas Aerospace
Communications & Electronics

Model 4H
HEX BODY ATTENUATORS

dc to 18.6 GHz

2 WATTS

SMA Connectors

FEATURES

- **Subminiature** - These attenuators offer the smallest package size with broadband frequency response, and attenuation values from 0 to 10, 20, and 30 dB.
- **Designed to meet environmental requirements of MIL-A-3933.**
- **Usable to 23 GHz.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.6 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
0	+ 0.2
1-10	± 0.3
20, 30	± 0.7

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 12.4	1.25
12.4 - 18.6	1.35

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watts @ 125 °C. 250 watts **peak** (5 µsec pulse width; 0.4% duty cycle).

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -50 °C to +125 ° C

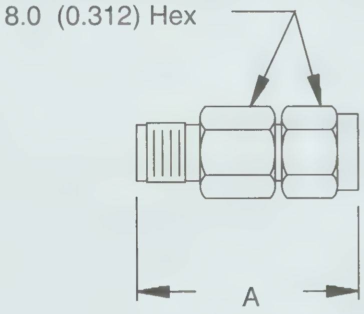
CALIBRATION: No test data available.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

WEIGHT: 5 g (0.18 oz) maximum

PHYSICAL DIMENSIONS:

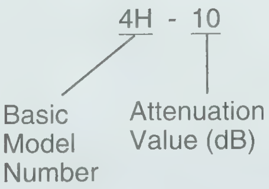


dB value	DIM A
0 thru 10	19.0 (0.75)
20	21.6 (0.85)
30	24.0 (0.95)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example



Model 3M dc to 12.4 GHz
Model 4M dc to 18.0 GHz
FIXED COAXIAL ATTENUATORS

2 WATTS

Ruggedized SMA Connectors

EXPRESS
800-542-4457

WEINSCHEL ENGINEERING MODEL NO.
3M

FEATURES

- Usable to 22 GHz.
- Rugged injection molded connectors.
- Designed to meet environmental requirements of MIL-A-3933.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: Model 3M: dc to 12.4 GHz
Model 4M: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	3M	4M
1 - 2	± 0.3	± 0.5
3 - 6	± 0.3	± 0.3
7 - 10	± 0.3	± 0.5
20	± 0.5	± 0.7
30, 40	± 0.75	± 1.0
50, 60	± 1.0	± 1.5

MAXIMUM SWR:

FREQUENCY (GHz)	3M	4M
dc - 4	1.15	1.15
4 - 8	1.20	1.20
8 - 12.4	1.25	1.25
12.4 - 18	N/A	1.35

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watts at 125 °C. 500 watts **peak** (5 µsec pulse width; 0.2% duty cycle).

U. S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: < 0.005 dB/dB/watts

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: Test data is available at additional cost.

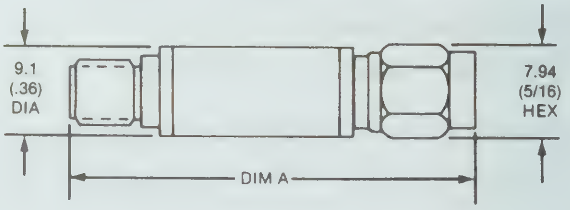
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

WEIGHT (Both Models):

dB VALUE	WEIGHT (Net)
1 - 10, 20	10 g (0.35 oz)
30, 40, 50, 60	20 g (0.70 oz)

PHYSICAL DIMENSIONS:



dB value	DIM A
1-10, 20	30.5 (1.20)
30, 40, 50, 60	47.0 (1.85)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example *3M - 10

Basic Model Number — *3M
Attenuation Value (dB) — 10

* Add Prefix M for double male and F for double female connectors

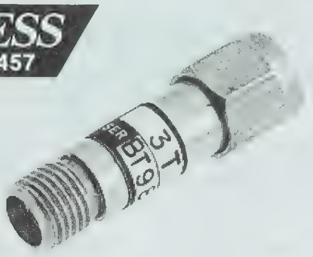
Model 3T
Model 4T
FIXED COAXIAL ATTENUATORS

dc to 12.4 GHz
dc to 18.0 GHz

2 WATTS

Ruggedized SMA Connectors

EXPRESS
800-542-4457



FEATURES

- **Usable to 22 GHz.**
- **Rugged injection molded connectors.**
- **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: Model 3T: dc to 12.4 GHz
Model 4T: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	3T	4T
1 - 6	± 0.3	± 0.3
7 - 12	± 0.3	± 0.5
20	± 0.5	± 0.7
30, 40	± 0.75	± 1.0
50, 60	± 1.0	± 1.5

MAXIMUM SWR:

FREQUENCY (GHz)	3T	4T
dc - 4	1.15	1.15
4 - 8	1.20	1.20
8 - 12.4	1.25	1.25
12.4 - 18	N/A	1.35

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watts at 125 °C. 500 watts **peak** (5 µsec pulse width; 0.2% duty cycle).

U. S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: < 0.005 dB/dB/Watts

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: Test data is available at additional cost.

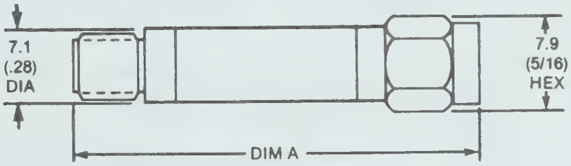
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper female contacts.

WEIGHT (Both Models):

dB VALUE	WEIGHT (Net)
1 - 12	3.9 g (0.14 oz)
20	4.3 g (0.15 oz)
30	4.9 g (0.23 oz)
40, 50, 60	6.5 g (0.23 oz)

PHYSICAL DIMENSIONS:

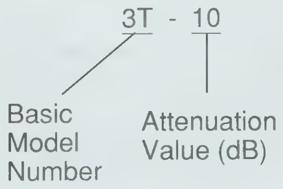


dB value	DIM A ± 0.2
1 - 12	21.8 (0.86)
20	23.9 (0.94)
30	26.4 (1.04)
40, 50, 60	34.0 (1.34)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example



Model 9
FIXED COAXIAL ATTENUATOR

dc to 26.5 GHz

2 WATTS

Ruggedized SMA Connectors

FEATURES

- Usable to 30 GHz.
- Ruggedized SMA connectors.
- Designed to meet environmental requirements of MIL-A-3933.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
3	± 0.5
6	± 0.6
10	± 0.8
20, 30	± 1.0

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.15
4 - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35
18 - 26.5	1.60

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watt @ 125 °C. 500 watts **peak** (5 µsec pulse width; 0.2 % duty cycle).

U. S. Patent Nos. 3,157,846; 3,260,971; 4,431,255

POWER COEFFICIENT: < 0.005 dB/dB/Watts

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C.

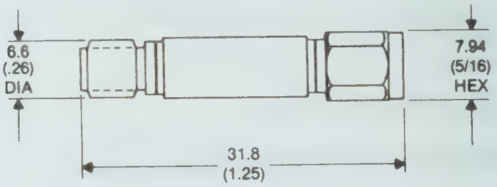
CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body; gold plated beryllium copper connectors and contacts.

WEIGHT: 4 g (0.14 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example *9 - 10

Basic Model Number — *9

Attenuation Value (dB) — 10

* Add Prefix M for double male and F for double female connectors

Model 54
FIXED COAXIAL ATTENUATOR

dc to 40.0 GHz

2 WATTS

Ruggedized SMA Connectors

D.C.-40GHz
WEINSCHEL
ENGINEERING

FEATURES

- Ruggedized SMA connectors.
- Designed to meet environmental requirements of MIL-A-3933.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 40 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION dc-18 GHz	18-26.5 GHz	26.5-40 GHz
3	± 0.4	± 0.7	± 1.1
6	± 0.4	± 0.7	± 1.0
10	± 0.4	± 0.8	± 1.0
20	± 0.7	± 1.0	± 1.0
30	± 1.0	± 1.4	± 1.4

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 26.5	1.35
26.5 - 40	1.60

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0.1 watt at 125 °C. 200 watts **peak** (5 µsec pulse width; 0.5 % duty cycle).

U.S. Patent No. 4,431,255

POWER COEFFICIENT: < 0.01 dB/dB/watts

TEMPERATURE COEFFICIENT: < 0.001 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

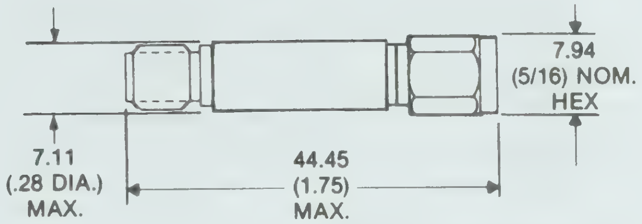
CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body ; gold plated beryllium copper connectors and contacts.

WEIGHT: 7.12 g (0.29 oz.) maximum

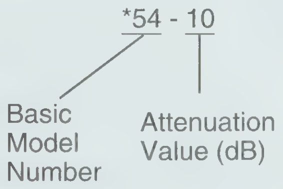
PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example



* Add Prefix M for double male and F for double female connectors

Models 55, 55P
FIXED COAXIAL TNC ATTENUATORS

dc to 18.0 GHz

5 WATTS

TNC/SMA Connectors

EXPRESS
800-542-4457

FEATURES

* **New TNC Connectors** - Both Attenuators incorporate the NEW 18 GHz TNC connector design standardized through the IEC.

* **Mechanical** - Model 55P is specifically designed for panel mounting and has an SMA female connector on the OUTPUT. This facilitates equipment packaging and provides mating with the widely used SMA male connectors on semi-rigid cables.

* **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
1, 2, 3, 4, 5, and 6	± 0.4
7, 8, 9, 10 and 20	± 0.5
30	± 0.9

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.15
4 - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35

POWER RATING: 5 watts **average** @ 25 ° C ambient temperature, derated linearly to 1 watt @ 125 ° C.
1 kilowatt **peak** (5 µsec pulse width; 0.25% duty cycle).

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

TEMPERATURE RANGE: -55 ° C to +125 ° C

CALIBRATION: Test data is available at additional cost.

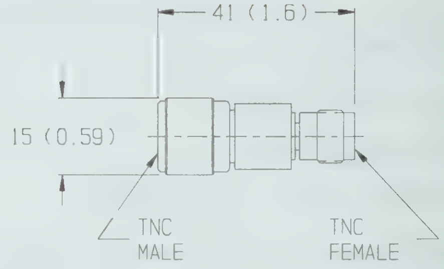
CONNECTORS: TNC and SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

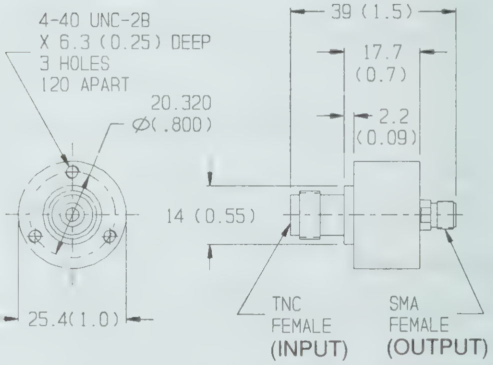
WEIGHT: 28 g (1 oz) maximum (Both Models)

PHYSICAL DIMENSIONS:

Model 55:



Model 55P:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example: 55 - 10

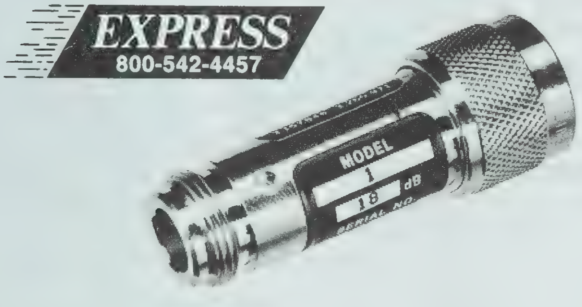
55: Basic Model Number
10: Attenuation Value (dB)

Model 1
Model 2
FIXED COAXIAL ATTENUATORS

dc to 12.4 GHz
dc to 18.0 GHz

5 WATTS

Type N Connectors



FEATURES

- * **Rugged injection molded connectors.**
- * **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: Model 1: dc to 12.4 GHz
Model 2: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	1	2
1- 9	± 0.3	± 0.3
10, 20	± 0.3	± 0.5
30, 40	± 0.75	± 1.0
50	± 0.75	± 1.25
60	± 1.0	± 1.5

MAXIMUM SWR:

FREQUENCY (GHz)	1	2
dc - 4	1.15	1.15
4 - 8	1.20	1.20
8 - 12.4	1.25	1.25
12.4 - 18	N/A	1.35

POWER RATING: 5 watts **average** to 25 ˚ C ambient temperature, derated linearly to 0.5 watts @ 125 ˚C. 1 kilowatt **peak** (5 µsec pulse width; 0.25% duty cycle).

U.S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: <0.005 dB/dB/Watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/˚C

TEMPERATURE RANGE: -55 ˚C to +125 ˚C

CALIBRATION: Test data is available at additional cost.

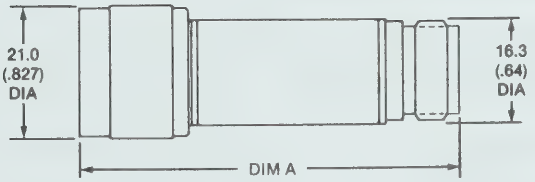
CONNECTORS: Semi-precision Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

WEIGHT (Both Models):

dB VALUE	WEIGHT (Net)
1 - 10, 20, 30 40, 50, 60	70 g (2.6 oz) 100 g (3.6 oz)

PHYSICAL DIMENSIONS:



dB value	DIM A
1-10, 20, 30 40, 50, 60	57.9 (2.28) 68.1 (2.68)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example:

*1 - 10

Basic Model Number

Attenuation Value (dB)

* Add Prefix M for double male and F for double female connectors

Lucas Aerospace
Communications & Electronics

Model 44
LAB STANDARD COAXIAL ATTENUATOR

dc to 18.0 GHz

5 WATTS

Precision Type N Connectors

EXPRESS
800-542-4457

FEATURES

- **Precision Connectors** - Interface dimensions per MIL-STD-348.
- **Calibration** - A certificate of calibration supplied with each attenuator.
- **Hex Nut Connector** - Allows for use of a torque wrench to apply additional coupling torque for improved connector repeatability.
- **Designed to meet most of the environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	44
1- 9 10, 20 30, 40 50, 60	± 0.3 ± 0.5 ± 1.0 ± 1.5

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4 4 - 12.4 12.4 - 18	1.15 1.20 1.25

POWER RATING: 5 watts average to 25 °C ambient temperature, derated linearly to 2 watts @ 85 °C.
1 kilowatt peak (5 µsec pulse width; 0.25% duty cycle).

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -50 °C to +85 °C

CALIBRATION: Insertion loss and SWR data supplied at dc, 4, 8, 12 and 18 GHz. Other test data available at additional cost.

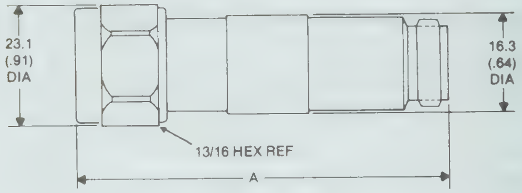
CONNECTORS: Precision Type N per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Coupling Torque: 14 ± 1 in/lbs. Recommended torque wrench LW Model 1915.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts.

WEIGHT:

dB VALUE	WEIGHT (Net)
1 - 10, 20, 30 40, 50, 60	100 g (3.6 oz) 140 g (5 oz)

PHYSICAL DIMENSIONS:



dB value	DIM A
1-10, 20, 30 40, 50, 60	76.2 (3.0) 86.4 (3.4))

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example:

*44 - 10

Basic Model Number

Attenuation Value (dB)

* Add Prefix M for double male and F for double female connectors

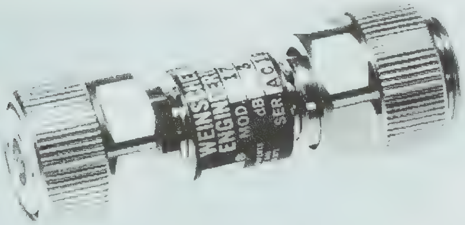
U.S. Patent Nos. 3,157,846; 3,260,971

Model 17
LAB STANDARD COAXIAL ATTENUATOR

dc to 18.0 GHz

5 WATTS

GPC-7 Connectors



FEATURES

- **GPC-7 Connectors per IEEE-STD-287.**
- **Calibration -** A certificate of calibration supplied with each attenuator.
- **Designed to meet most of the environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
1- 9	± 0.3 dB
10, 20	± 0.5 dB
30, 40, 50	± 0.75 dB
60	± 1.0 dB

MAX SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.10
4 - 121415	
12.4 - 18	1.20

POWER RATING: 5 watts **average** to 25 °C ambient temperature, derated linearly to 2 watts @ 85 °C.
1 kilowatt **peak** (5 µsec pulse width; 0.25% duty cycle).

POWER COEFFICIENT: < 0.0015 dB/dB/Watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: - 50 °C to + 85 °C.

CALIBRATION: Insertion loss and SWR data supplied at dc, 4, 8, 12 and 18 GHz. Other test data available at additional cost.

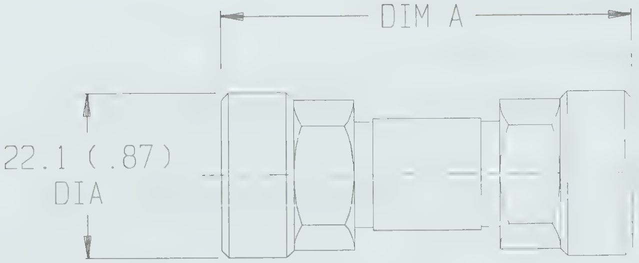
CONNECTORS: GPC-7 connectors mate with other connectors conforming to IEEE-STD-287. Coupling Torque: 14 ± 1 in/lbs.

CONSTRUCTION: Stainless steel body and beryllium copper ground and center contacts.

WEIGHT:

dB VALUE	WEIGHT (Net)
1 - 10, 20, 30	100 g (3.6 oz)
40, 50, 60	140 g (5 oz)

PHYSICAL DIMENSIONS:



dB value	DIM A
1-10, 20, 30	57.9 (2.28)
40, 50, 60	68.1 (2.68)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example:

$\underline{17} - \underline{10}$

17: Basic Model Number
10: Attenuation Value (dB)

U.S. Patent Nos. 3,157,846; 3,260,971

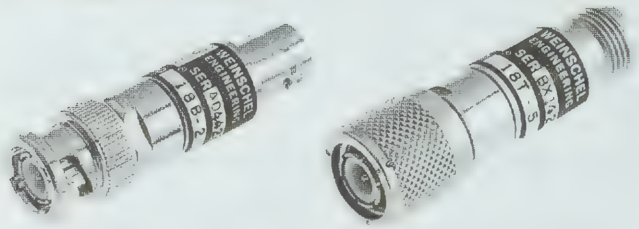
Model 18B
Model 18T
FIXED COAXIAL ATTENUATORS

dc to 12.4 GHz
dc to 15.0 GHz

2 WATTS

BNC, TNC Connectors

EXPRESS
800-542-4457



FEATURES

- **Designed to meet environmental requirements of MIL-A-3933.**
- **Long Life Connectors**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: Model 18B: dc to 12.4 GHz
Model 18T: dc to 15.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
1, 2, 3, 4, 5, and 6	± 0.4 dB
7, 8, 9, 10, 20, and 30	± 0.8 dB

MAXIMUM SWR:

FREQUENCY (GHz)	18B	18T
dc - 4	1.25	1.25
4 - 8	1.30	1.30
8 - 12.4	1.35	1.35
12.4 - 15	N/A	1.40

POWER RATING: 2 watts **average** to 25 ˚C ambient temperature, derated linearly to 0.5 watts @ 125 ˚C. 500 watts **peak** (5 µsec pulse width; 0.2% duty cycle).

U.S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/˚C

TEMPERATURE RANGE: -55 ˚C to +125 ˚C.

CALIBRATION: Test data is available at additional cost.

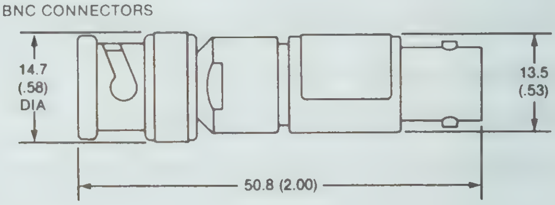
CONNECTORS: BNC and TNC connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Gold plated brass male inner conductor. Gold plated beryllium copper, heat treated female inner conductor. Heat treated beryllium copper male outer conductor, nickel plated. Female outer conductor and main body nickel plated brass.

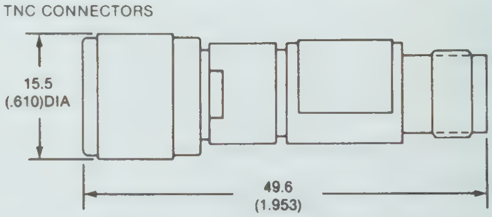
WEIGHT: 110 g (4 oz) maximum

PHYSICAL DIMENSIONS:

MODEL 18B



MODEL 18T



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example:

18B - 10

Basic Model Number
Attenuation Value (dB)

MODEL 41
MEDIUM POWER FIXED COAXIAL ATTENUATOR

dc to 18.0 GHz

10 WATTS

Ruggedized SMA Connectors

EXPRESS
800-542-4457

FEATURES

- **Designed to meet environmental requirements of MIL-A-3933.**
- **Rugged injection molded SMA connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
1, 2	± 0.5 dB
3, 6	± 0.3 dB
10	± 0.5 dB
20	± 0.7 dB
30	± 1.0 dB

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.20
4 - 12.4	1.30
12.4 - 18	1.35

POWER RATING (mounted horizontally): 10 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 125 °C.
1 Kilowatt **peak** (5 µsec pulse width; 0.5% duty cycle).

U.S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: < 0.0015 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: Insertion loss data supplied at dc, 4.0, 8.0, 12.0 and 18.0 GHz. Other test data can be provided at additional cost.

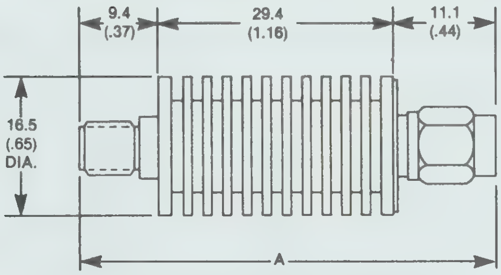
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
1	SMA, Female
2	SMA, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: 28g (1 oz) maximum

PHYSICAL DIMENSIONS:



Model No.	DIM A
41-XX-12	50.0 (1.97)
41-XX-11	48.2 (1.90)
41-XX-22	51.6 (2.03)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

41 - 10 - 12

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Lucas Aerospace

Communications & Electronics

Model 23
MEDIUM POWER FIXED COXIAL ATTENUATOR

dc to 18.0 GHz

10 WATTS

Type N Connectors

EXPRESS
800-542-4457

FEATURES

* **Quality connectors with special high temperature support beads.**

* **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
1, 2	± 0.50 dB
3, 6	± 0.30 dB
10, 20	± 0.50 dB
30, 40	± 1.00 dB
50	± 1.25 dB
60	± 1.50 dB

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.15
4 - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35

POWER RATING (mounted horizontally): 10 watts **average** to 25 °C ambient temperature, derated linearly to 1 watts @ 125 °C.
1 kilowatt **peak** (5 µsec pulse width; 0.5 % duty cycle).

U. S. Patent Nos. 3,157,1846; 3,260,971

POWER COEFFICIENT: <0.0005 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insetion loss test data supplied at dc, 4.0, 8.0, 12.0, and 18.0 GHz. Other test data can be provided at additional cost.

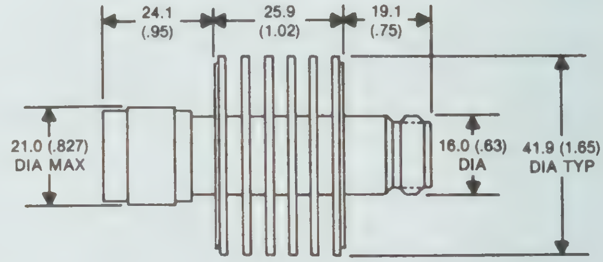
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: Net 110 g (4 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

23 - 10 - 34

Basic Model Number

Attenuation Value (dB)

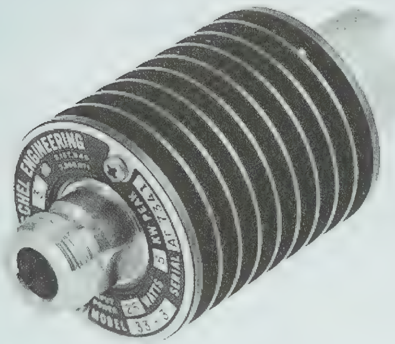
Connector Options
1st digit is input side
2nd digit is output side

MODEL 33
MEDIUM POWER FIXED COAXIAL ATTENUATOR

dc to 8.0 GHz

25 WATTS

Type N Connectors



FEATURES

- **Quality connectors with special high temperature support beads.**
- **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 8.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION dc - 4 GHz	DEVIATION 4 - 8 GHz
3, 6, 10, 20	±0.3	±0.6
30	±0.6	±1.0

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.20
4 - 8	1.30

POWER RATING (mounted horizontally): 25 watts **average** to 25 °C ambient temperature, derated linearly to 2.5 watts @ 125 °C.
5 Kilowatt **peak** (5 µsec pulse width; 0.25% duty cycle).

U.S. Patent Nos. 3,157,846; 3,260,971

POWER COEFFICIENT: < 0.0006 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to + 125 °C

CALIBRATION: Insertion loss test data is supplied at dc, 4.0 and 8.0 GHz. Other test data can be provided at additional cost.

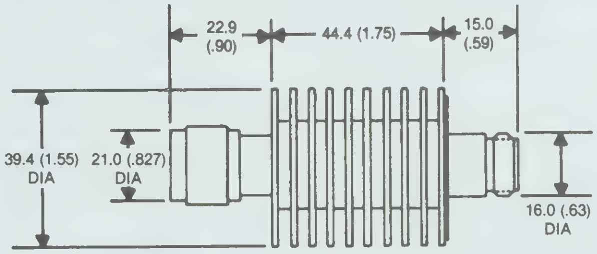
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: 170 g (6 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

33 - 10 - 34

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Lucas Aerospace

Communications & Electronics

Model 24 dc to 8.0 GHz

MEDIUM POWER FIXED COXIAL ATTENUATOR 50 WATTS

Type N, SMA, TNC, GPC-7 Connectors

EXPRESS
800-542-4457

FEATURES

- Designed to meet environmental requirements of MIL-A-3933.
- Wide variety of connector options.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 8.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION dc - 4 GHz	DEVIATION 4 - 8 GHz
3, 6, 10, 20, 30, 40	± 0.40	± 0.75

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.20
4 - 8	1.30

POWER RATING (mounted horizontally): 50 watts **average** (unidirectional) to 25 °C ambient temperature, derated linearly to 5 watts @ 125 °C.
5 kilowatt **peak** (5 µsec pulse width; 0.5 % duty cycle). Maximum power rating into output port is 20 watts average.

POWER COEFFICIENT: <0.0003 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C. (+85 °C with GPC-7 connector option.

CALIBRATION: Insetion loss testdata supplied at dc, 4.0, and 8.0 GHz. Other test data can be provided at additional cost.

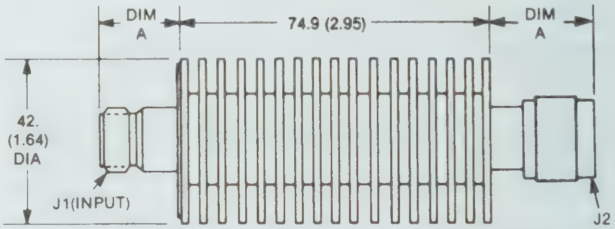
CONNECTORS: SMA, Type N, and TNC connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. GPC-7 connectors per IEEE-STD-287.

Connector Options	Type/Description
1	SMA, Female
2	SMA, Male
3	Type N, Female
4	Type N, Male
5	GPC-7
6	TNC, Female
7	TNC, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: Net 280 g (10 oz) maximum

PHYSICAL DIMENSIONS:



CONN. TYPE	DIM A	CONN. TYPE	DIM A
N, Male	22.9 (0.90)	TNC, Male	35.1 (1.38)
N, Female	15.0 (0.59)	TNC, Female	38.1 (1.50)
SMA, Male	14.0 (0.55)	GPC-7	21.0 (0.82)
SMA, Female	12.7 (0.50)		

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

24 - 10 - 11

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

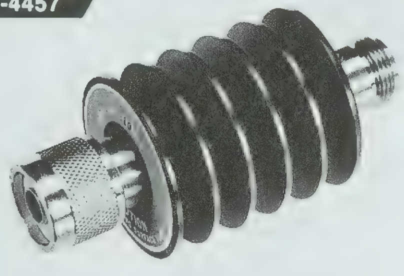
MODEL 46
MEDIUM POWER FIXED COAXIAL ATTENUATOR

dc to 18.0 GHz

25 WATTS

Type N Connector

EXPRESS
800-542-4457



FEATURES

- * **Designed to meet environmental requirements of MIL-A-3933.**
- * **Rugged injection molded connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
3, 6, 10	± 0.50 dB
20	± 0.75 dB
30, 40	± 1.00 dB

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35

POWER RATING (mounted horizontally): 25 watts **average** (unidirectional) to 25 °C ambient temperature, derated linearly to 2.5 watts @ 125 °C.
1 Kilowatt **peak** (5 µsec pulse width; 1.25% duty cycle). Maximum power rating into output port is 10 watts average.

POWER COEFFICIENT: < 0.0006 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: Insertion loss test data is supplied at dc, 4.0, 8.0, 12.4 and 18.0 GHz. Other test data can be provided at additional cost.

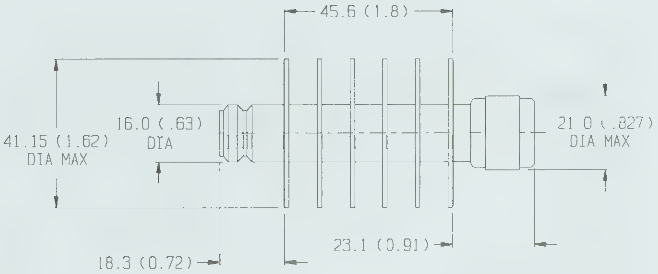
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body; stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: 100 g (3.5 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

46 - 10 - 34

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Lucas Aerospace

Communications & Electronics

MODEL 47
HIGH POWER FIXED COAXIAL ATTENUATOR

dc to 18.0 GHz

50 WATTS

Type N connectors

EXPRESS
800-542-4457

FEATURES

- **Designed to meet environmental requirements of MIL-A-3933.**
- **Rugged injection molded connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
10	± 0.50 dB
20	± 0.75 dB
30, 40	± 1.00 dB

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35

POWER RATING (mounted horizontally): 50 watts **average** (unidirectional) to 25 °C ambient temperature, derated linearly to 5 watts @ 125 °C.
1 Kilowatt **peak** (5 microsec pulse width; 2.5% duty cycle). Maximum power rating into ouptut port is 10 watts average.

POWER COEFFICIENT: < 0.0003 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to +125 °C

CALIBRATION: Insertion loss test data is supplied at dc, 4.0, 8.0, 12.4 and 18.0 GHz. Other test data can be provided at additional cost.

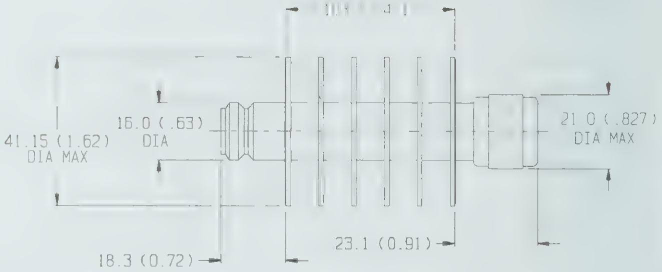
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body; stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: 175 g (6 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

47 - 10 - 34

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Model 48
HIGH POWER FIXED COAXIAL ATTENUATOR

dc to 18.0 GHz

100 WATTS

Type N Connectors

EXPRESS
800-542-4457

FEATURES

- **Designed to meet environmental requirements of MIL-A-3933.**
- **Rugged injection molded connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM DEVIATION OVER FREQUENCY:

NOM ATTN (dB)	DEVIATION (dB)
10	± 1.25
20	± 0.75
30, 40	± 1.00

MAXIMUM SWR:

FREQUENCY (GHz)	10	20,30,40
dc - 8	1.40	1.25
8 - 12.4	1.40	1.35
12.4 - 18	1.55	1.45

POWER RATING (mounted horizontally): 100 watts **average** (unidirectional) to 25 °C ambient temperature, derated linearly to 10 watts @ 125 °C.
1 kilowatt **peak** (5 µsec pulse width; 5% duty cycle).
Maximum power rating into output port is 10 watts average.

POWER COEFFICIENT: <0.00015 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insertion loss test data supplied at dc, 4.0, 8.0, 12.4, and 18.0 GHz. Other test data can be provided at additional cost.

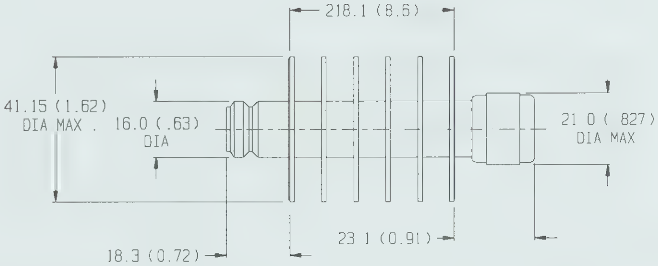
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors with gold plated beryllium copper contacts.

WEIGHT: Net 320 g (11 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

48 - 20 - 34

Basic Model Number

Attenuation Value (dB)

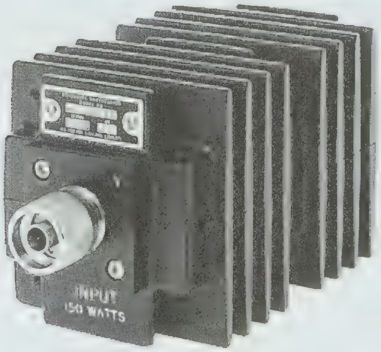
Connector Options
1st digit is input side.
2nd digit is output side.

Model 40
HIGH POWER
FIXED COXIAL ATTENUATOR

dc to 1.5 GHz

150 WATTS

Type N Connectors



FEATURES

- **Quality connectors with special high temperature support beads.**
- **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 1.5 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
3, 6, 10, 20, 30, 40	± 0.5

MAXIMUM SWR: 1.10

POWER RATING (mounted horizontally): 150 watts **average** to 55 °C ambient temperature, derated linearly to 15 watts @ 125 °C.
10 kilowatt **peak** (5 µsec pulse width; 0.75% duty cycle). Maximum power rating into output port is 20 watts average.

POWER COEFFICIENT: <0.0001 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insetion loss test data supplied at dc, and 1.5 GHz. Other test data can be provided at additional cost.

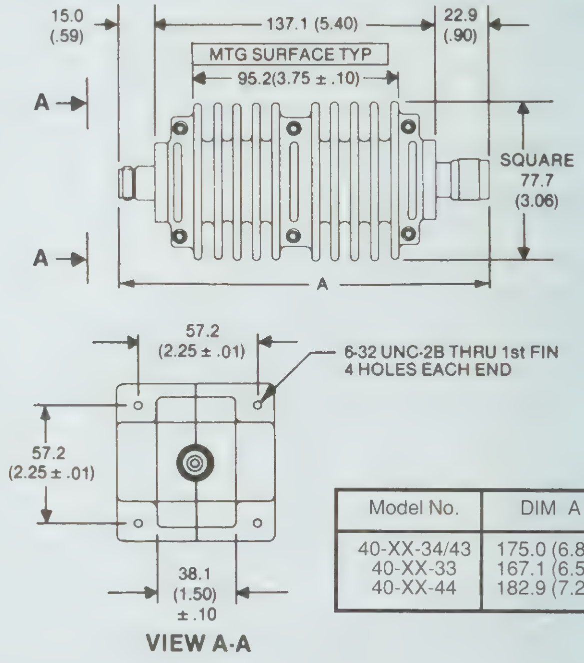
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contact or stainless steel male contact.

WEIGHT: Net 1,130 g (2 lbs, 8 oz) maximum

PHYSICAL DIMENSIONS:



Model No.	DIM A
40-XX-34/43	175.0 (6.89)
40-XX-33	167.1 (6.58)
40-XX-44	182.9 (7.20)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

40 - 10 - 43

Basic Model Number

Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Lucas Aerospace
Communications & Electronics

Model 45
HIGH POWER FIXED COXIAL ATTENUATOR

dc to 1.5 GHz

250 WATTS

Type N Connectors

INPUT
250 WATTS

FEATURES

- **Quality connectors with special high temperature support beads.**
- **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 1.5 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION
3, 6, 10, 20, 30, 40	± 0.5

MAXIMUM SWR: 1.10

POWER RATING (mounted horizontally): 250 watts **average** to 55 °C ambient temperature, derated linearly to 25 watts @ 125 °C.
10 kilowatt **peak** (5 µsec pulse width; 1.25% duty cycle). Maximum power rating into output port is 50 watts average.

POWER COEFFICIENT: <0.0001 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insetion loss test data supplied at dc, and 1.5 GHz. Other test data can be provided at additional cost.

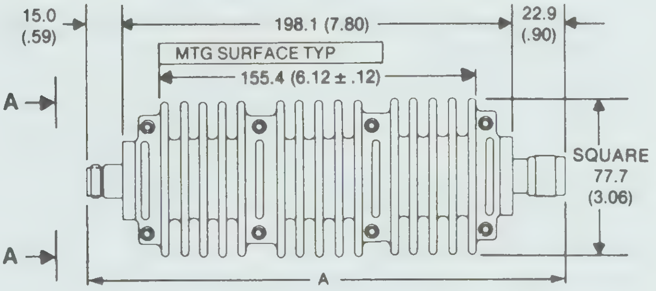
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

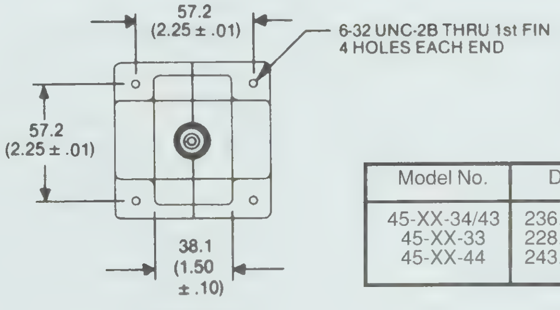
Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contact or stainless steel male contact.

WEIGHT: Net 1,530 g (3 lbs, 6 oz) maximum

PHYSICAL DIMENSIONS:





VIEW A-A

Model No.	DIM A
45-XX-34/43	236.0 (9.29)
45-XX-33	228.1 (8.98)
45-XX-44	243.9 (9.60)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

45 - 10 - 43

Basic Model Number

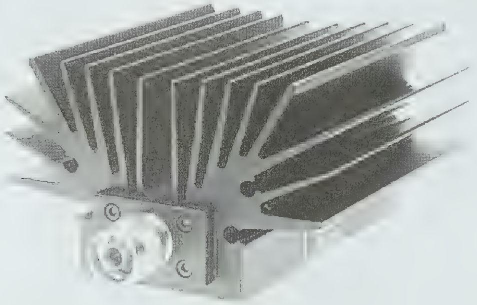
Attenuation Value (dB)

Connector Options
1st digit is input side
2nd digit is output side

Model 49
HIGH POWER FIXED COXIAL ATTENUATOR
Type N Connectors

dc to 8.5 GHz

150 WATTS



FEATURES

- **Quality connectors with special high temperature support beads.**
- **Designed to meet environmental requirements of MIL-A-3933.**
- **Flexible Mounting Position** - The units may be mounted in horizontal (fins up) or vertical position.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 8.5 GHz

MAXIMUM DEVIATION OVER FREQUENCY (dB):

NOM ATTN (dB)	DEVIATION	
	dc - 4 GHz	4 - 8.5 GHz
3, 6, 10, 20, 30, 40 40	± 0.40 ± 0.50	± 0.75 ± 1.00

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4 4 - 8.5	1.25 1.35

POWER RATING: 150 watts **average** (unidirectional) to 35 °C ambient temperature, derated linearly to 15 watts @ 125 °C.
10 kilowatt **peak** (5 µsec pulse width; 1.5% duty cycle). Maximum power rating into output port is 20 watts average.

POWER COEFFICIENT: <0.0001 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insetion loss test data supplied at dc, and 4.0, and 8.0 GHz. Other test data can be provided at additional cost.

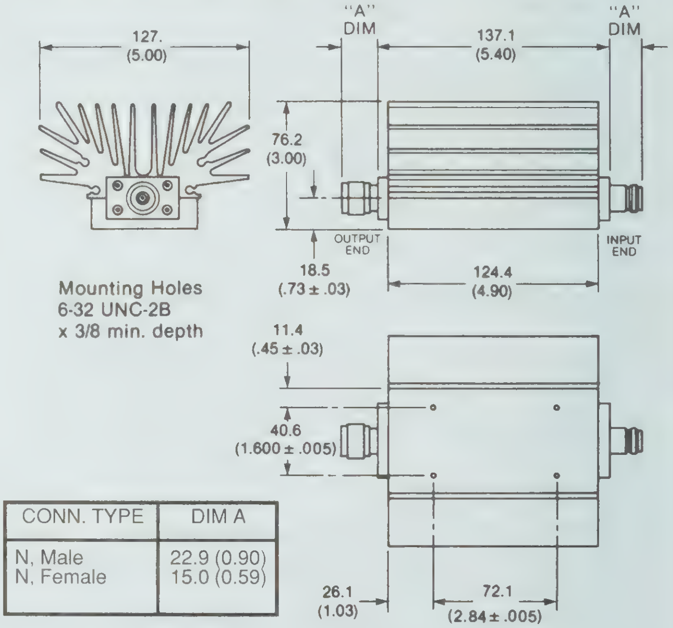
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contact or stainless steel male contact.

WEIGHT: Net 1,450 g (3 lbs, 3 oz) maximum

PHYSICAL DIMENSIONS:



CONN. TYPE	DIM A
N, Male N, Female	22.9 (0.90) 15.0 (0.59)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

49 - 10 - 43

49	10	43
Basic Model Number	Attenuation Value (dB)	Connector Options 1st digit is input side 2nd digit is output side

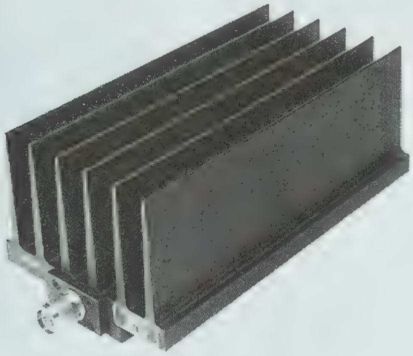
P. O. Box 6001, Gaithersburg, Maryland 20884-6001
TEL: (301) 948-3434, **800-638-2048**
TELEFAX: 301-948-3625, TLX: 440702

Model 53
HIGH POWER FIXED COAXIAL ATTENUATOR

dc to 2.5 GHz

500 WATTS

Type N Connectors



FEATURES

- **Quality connectors with special high temperature support beads.**
- **Designed to meet environmental requirements of MIL-A-3933.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 1.5 GHz

MAXIMUM DEVIATION OVER FREQUENCY:

NOM ATTN (dB)	DEVIATION (dB)
10	± 1.0
20, 30, 40	± 0.5

MAXIMUM SWR: 1.10

POWER RATING: 500 watts **average** (unidirectional) to 35 °C ambient temperature, derated linearly to 50 watts @ 125 °C.
10 kilowatt **peak** (5 µsec pulse width; 2.5% duty cycle). Maximum power rating into output port is 50 watts average.

POWER COEFFICIENT: <0.0001 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/°C

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: Insertion loss test data supplied at dc, and 1.5 GHz. Other test data can be provided at additional cost.

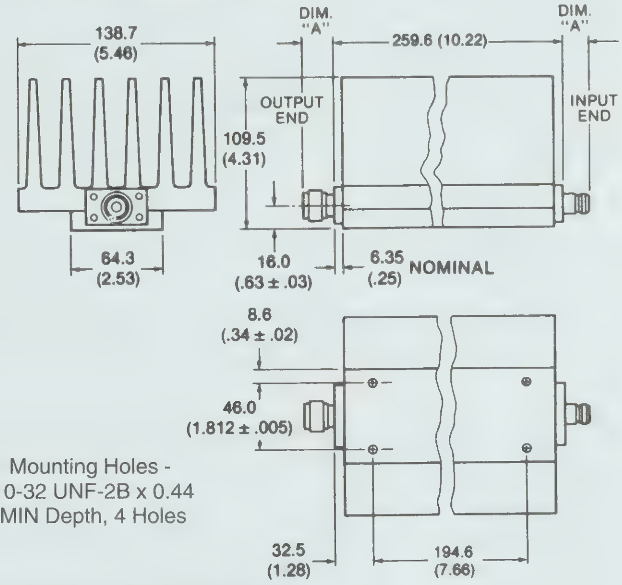
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contact or stainless steel male contact.

WEIGHT: Net 3,640 g (8 lbs) maximum

PHYSICAL DIMENSIONS:



CONN. TYPE	DIM A
N, Male	22.9 (0.90)
N, Female	15.0 (0.59)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL NUMBER DESCRIPTION:

Example

53 - 10 - 34

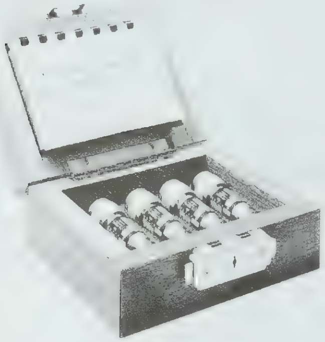
Basic Model Number

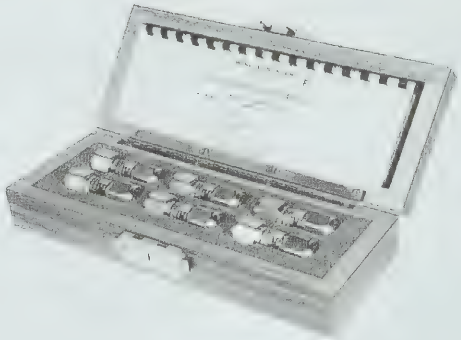
Attenuation Value (dB)

Connector Options
1st digit is input side.
2nd digit is output side.

CALIBRATED ATTENUATOR SETS

Model AS-6 (Type N)





Model AS-16 (Precision GPC-7)
Model AS-18 (Precision Type N)

Model AS-19 (SMA)

Model AS-20 (3.5 mm) not shown.

FEATURES

- **Calibration Data:** Certificate of Calibration for each attenuator is provided within the case. Data furnished: 3 dc resistance values and insertion loss every 1.0 GHz. The Calibration data is traceable to NIST.
- **Wde Temperature Range:** -55 °C to 125 °C. Full rated power to 25 °C. derated Linerity to 0.5 watts @ 125 °C.
- **Uniform Phase Characteristics:** Excellent unit-to-unit tracking and phase linearity with frequency.
- **Rugged Construction:** Designed to meet all environmental requirements of MIL-A-3933.
- **High Repeatability Connectors**:
  - AS-6: Type N per MIL-STD-348
  - AS-16: GPC-7 per IEEE-STD-287
  - AS-18: Precision N per MIL-STD-348
  - AS-19: SMA per MIL-STD-348
  - AS-20: Precision 3.5 mm
- **Durable Storage Case.**

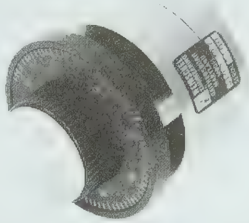
SET MODEL NUMBER	STANDARD MODEL NUMBER	NOMINAL VALUES (dB)	FREQUENCY RANGE (GHz)	AVERAGE POWER (W)	CONNECTOR TYPE	MAXIMUM[1] SWR	PAGE[2]
AS-6	2	3, 6, 10, 20	dc-18 GHz	5	N	1.15 - 1.35	21
AS-16	17	1, 3, 6, 10, 20, 30	dc-18 GHz	5	GPC-7	1.10 - 1.20	23
AS-18	44	1, 3, 6, 10, 20, 30	dc-18 GHz	5	N	1.15 - 1.25	22
AS-19	9	3, 6, 10, 20	dc-26.5 GHz	2	SMA	1.10 - 1.60	18
AS-20	56	3, 6, 10, 20, 30	dc-26.5 GHz	2	3.5 mm	1.10 - 1.25	viii

1. Varies with frequency.
2. Refer to indicated page for more detailed attenuator specifications.

STORAGE CASE. DIMENSIONS:

Model AS-6:	136.5 mm (5-3/8 in) long x 125.4 mm (4-15/16 in) wide x 35.6 mm (2-3/16 in) high
Model AS-16:	269.9 mm (10-5/8 in) long x 203.2 mm (8 in) wide x 60.3 mm (2-3/8 in) high
Model AS-18:	215.9 mm (8.5 in) long x 273 mm (10-3/4 in) wide x 63.5 mm (2-1/2 in) high
Model AS-19:	139.7 mm (5-1/2 in) long x 123.8 mm (4-7/8 in) wide x 60.3 mm (2-3/8 in) high
Model AS-20:	139.7 mm (5-1/2 in) long x 123.8 mm (4-7/8 in) wide x 60.3 mm (2-3/8 in) high

Continuously Variable Attenuators



GENERAL INFORMATION

Lucas Weinschel offers a wide selection of variable attenuators. The Lucas Weinschel variable attenuators line provides their users with a number of features:

- **Continuously Variable Attenuation** - Most models are in linear scales, and low frequency sensitivity with broad frequency coverage, resulting from the use of proven Lucas Weinschel resistive films
- Direct reading, individually calibrated incremental insertion loss dials.
- **Stability** - The resistive elements located in these Variable Attenuators provide long-term stability over temperature and humidity.
- **Quality Connectors** - Most Lucas Weinschel Variable Attenuators are supplied with stainless steel Type N or SMA connectors that mate nondestructively with connectors per MIL-C-39012.
- **Broadband** - The Lucas Weinschel Precision continuously variable attenuator line provides a selection of frequency ranges from dc to 4.2 GHz, continuous incremental attenuation ranges up to 127 dB, and input handling capabilities to 5 watts.
- **High Repeatability**
- **Level Set Versions** - All models of Lucas Weinschel Variable Attenuators are available in uncalibrated level set versions for either bench or panel mounting.

In this section of the catalog, each Variable Attenuator is outlined ultilizing individual data sheets containing product features, specifications, and outline drawings. These data sheets are preceded by a quick reference guide to help you select the Variable Attenuator(s) that fits your needs. The page number for each Variable Attenuator data sheet is given in the quick reference guide.

APPLICATIONS

Variable attenuators are used in applications where the need exists for controlling signal levels continuously without interrupting the circuit.

Continuously Variable Attenuator Quick Reference Guide

Model Number	Connector Type	Frequency Range (GHz)	Average Power (W)	Peak Power (kW)	Incremental Insertion Loss (dB)	Maximum Attenuation Range (dB)	Maximum SWR	Page No.
3100-127	SMA	dc to 2.0	2	0.5	6	127	1.60	38
910	SMA/N	dc to 4.2	1	0.5	1	10, 20	1.75	39
940-60	SMA/N	dc to 4.0	5	0.5	6	60	1.80	41
940-114	SMA/N	dc to 2.0	5	0.5	6	114	1.60	41

Model 3100-127
PRECISION CONTINUOUSLY VARIABLE ATTENUATOR
SMA Connectors

dc to 2.0 GHz

2 WATTS

FEATURES

- **Compact Size** - Smallest available precision variable attenuator with 127 dB incremental range. Provides the OEM with new flexibility in designing compact instrumentation.
- **Continuously Variable** - Attenuation is continuously variable between "minimum insertion loss (6 dB)" and 133 dB providing a 127 dB incremental range.
- **Rugged** - Designed to meet many requirements of MIL-A-24215.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 2.0 GHz

INCREMENTAL ATTENUATION RANGE: 127 dB

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

6 ± 0.5 dB

CALIBRATION FREQUENCY/ACCURACY (including resetability): ± 0.5 dB or 1% whichever is greater. Test data is available at additional cost.

FREQUENCY SENSITIVITY:

± {0.015 x A x (F - Fd) + 0.5} or
± {0.015 x A x (F - Fd) + 0.1 x A}

A = Attenuation setting in dB, Fd = Dail cut frequency in GHz, F= Operation frequency in GHz

DIRECT READING DIAL CALIBRATED AT: 1.0 GHz

DIAL INCREMENTS: 2 dB increments from 6 to 130 dB plus 3 dB

RESOLUTION OF DIAL: ~ 270 ° full scale (6 to 133 dB)

LIFE: 50,000 Cycles (A cycle consists of a rotation from minimum to maximum and back to minimum).

MAXIMUM SWR (input and output): 1.60

PHASE SHIFT WITH CHANGE IN ATTENUATION:

~ 1° per dB x f(GHz)

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 0 watts @ 85 °C.
500 watts **peak** (5 µsec pulse width; 0.2 % duty cycle)

MAXIMUM STARTING TORQUE: 30 inch ounces

POWER COEFFICIENT: <0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.001 dB/dB/ °C

TEMPERATURE RANGE:

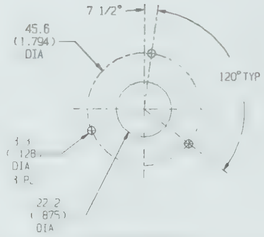
Operating:	0 °C to 85 °C
Non-operating:	-55 °C to 85 °C.

CONNECTORS: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

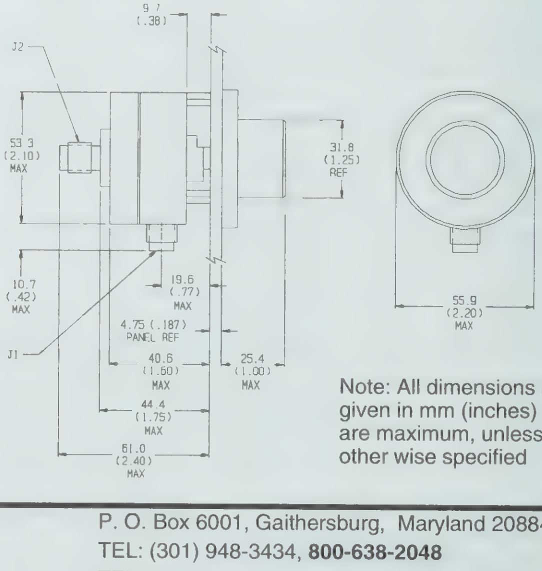
CONSTRUCTION: Aluminum body and stainless steel connectors; gold plated beryllium copper contacts. Knob is included with each unit.

WEIGHT: 247 g (8.75 oz)

PHYSICAL DIMENSIONS:



MOUNTING PATTERN



Note: All dimensions are given in mm (inches) and are maximum, unless other wise specified

Model 910
CONTINUOUSLY VARIABLE ATTENUATOR

dc to 4.2 GHz

1 WATT

SMA or Type N Connectors

FEATURES

- **Excellent Phase Characteristics** - Near constant phase shift with attenuation; nearly linear with frequency
- **Choice of Attenuation Ranges** - Available in two continuously variable, calibrated attenuation ranges from minimum to 10 dB and to 20 dB. A 20 dB Level Set Unit is also available.
- **Accurate** - Attenuation dial is individually calibrated in 0.5 dB increments at 2 GHz. Calibration accuracy, including resetability, is ± 0.3 dB to full range.
- **Low Frequency Sensitivity** - Small attenuation variations with frequency over the entire range of attenuation.
- **Choice of Connectors** - Long-life stainless steel SMA female or Type N female.
- **Rugged** - Designed to meet many requirements of MIL-A-24215.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 4.2 GHz.

CHARACTERISTIC INSERTION LOSS, INCREMENTAL (Attenuation Ranges):

910-10: 0 to 10 dB (calibrated)
910-20: 0 to 20 dB (calibrated)
910LS: 0 to 20 dB (level set)

DIRECT READING DIAL CALIBRATION: 2.0 GHz

DIAL INCREMENTS: 1 dB

RESOLUTION OF DIAL: ~270 ° minimum

CALIBRATION FREQUENCY/ACCURACY: 2.0 GHz (others available upon request): ± 0.3 dB @ 23 °C, includes resetability. Calibration is performed on an incremental basis above the residual insertion loss as standard. Calibration of total insertion loss (terminal to terminal) can be provided at additional cost.

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

dc to 2 GHz: 0.7 dB (maximum).
2 to 4.2 GHz: 1.0 dB (maximum).

FREQUENCY SENSITIVITY: ± 1.5 dB maximum across full frequency range.

MAXIMUM SWR (input and output):

1.25 + 0.12 x F(GHz)

PHASE SHIFT WITH CHANGE IN ATTENUATION:

1° per dB x f(GHz) maximum

POWER RATING: 1 watt **average** to 25 °C ambient temperature, derated linearly to 0.5 watts @ 85 °C. 500 watts **peak** (5 µsec pulse width; 0.1% duty cycle)

POWER COEFFICIENT: < 0.005/dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.001/dB/dB/ °C

TEMPERATURE RANGE:

Operating: 0 °C to 85 °C
Non-operating: -55 °C to 85 °C.

SPECIFICATIONS (Con't)

CONNECTORS: SMA female or Type N female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
11	SMA, Female
33	Type N, female

CONSTRUCTION: Aluminum body and stainless steel connectors; gold plated beryllium copper contacts. Knob is included with each unit.

WEIGHT: Net, 310 g (11 oz)

MODEL NUMBER DESCRIPTION:

Example

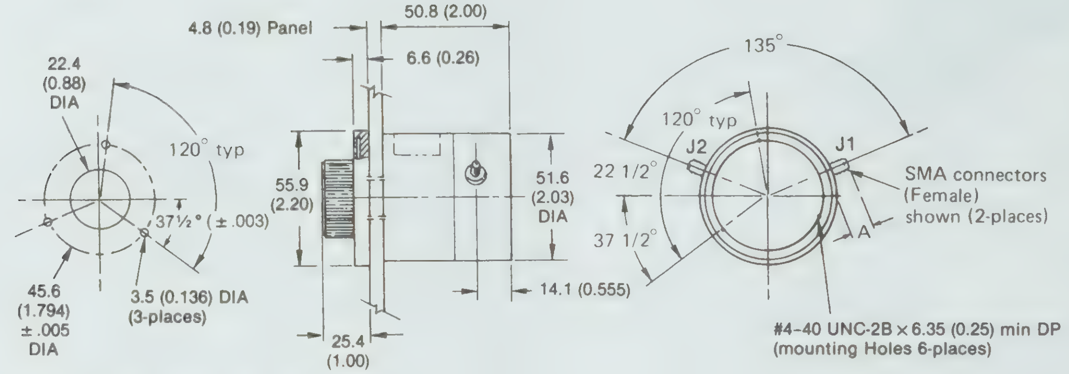
910 - 10 - 11

910	10	11
Basic Model Number	Attenuation Value (dB) or LS*	Connector Options

* LS indicates "Level Set" (uncalibrated version) and provides 20 dB of available incremental attenuation.

PHYSICAL DIMENSIONS:

Model No.	DIM A
910-XX-11 910-XX-33	9.53 (0.375) 19.1 (0.75)


22.4 (0.88) DIA
120° typ
37½° (± .003)
45.6 (1.794) ± .005 DIA
3.5 (0.136) DIA (3-places)
4.8 (0.19) Panel
50.8 (2.00)
6.6 (0.26)
55.9 (2.20)
51.6 (2.03) DIA
14.1 (0.555)
25.4 (1.00)
135°
120° typ
J2
J1
22 1/2°
37 1/2°
SMA connectors (Female) shown (2-places)
A
#4-40 UNC-2B × 6.35 (0.25) min DP (mounting Holes 6-places)

Panel Mounting Pattern (all units)

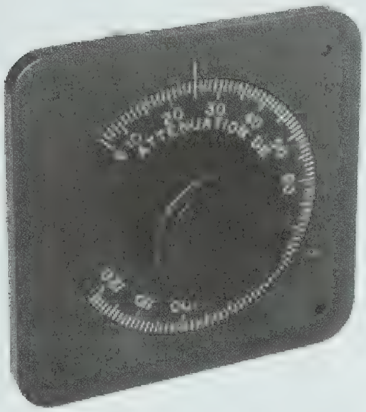
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U.S. Patents 3,260,971, 3,786,374, 3,157,846

Model 940-60 dc to 4.0 GHz
Model 940-114 dc to 2.0 GHz
PRECISION CONTINUOUSLY VARIABLE ATTENUATORS

5 WATTS

Type N or SMA Connectors



FEATURES

- * **Wide Variable Attenuation Range** - Variable attenuation range of 60 dB for Model 940-60 and 114 dB for Model 904-114, with minimum insertion loss at 6 dB.
- * **Approximately Linear Calibrated Dial** - Direct reading dial individually calibrated in approximately linear 1 dB increments from 6 dB to full scale.
- * **Rugged** - Designed to meet the environmental requirements of MIL-A-24215.
- * **Long Life** - These variable attenuators offer a cycle life of up to 10,000 cycles. Optional models are also available to extend the life to 50,000 cycles.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE:

Model 940-60:	dc to 4.0 GHz
Model 940-114:	dc to 2.0 GHz

INCREMENTAL ATTENUATION RANGE:

Model 940-60:	60 dB
Model 940-114:	114 dB

MAXIMUM SWR (Input and Output):

FREQUENCY (GHz)	SWR
dc - 1	1.50
1 - 2	1.60
2 - 3	1.70
3 - 4	1.80

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

6 dB nominal

DIAL CALIBRATION (in 1 dB increments):

Model 940-60:	6 to 66 dB
Model 940-114:	6 to 120 dB

DIAL ACCURACY:

Model No.	ACCURACY
940-60-XX 940-114-XX	± 0.25 dB or 0.4 % @ 2 GHz ± 0.25 dB or 0.4 % @ 1 GHz
940-60-XX-1 940-114-XX-1	± 0.5 dB or 1 % @ 2 GHz ± 0.5 dB or 1 % @ 1 GHz

DIAL INCREMENTS: 1 dB

RESOLUTION OF SCALE:

Model 940-60:	~ 180°
Model 940-114:	~ 270°

CYCLE LIFE: A cycle consists of a rotation from minimum to maximum and back to minimum

Model 940-XX-XX :	10,000
Model 940-XX-XX-1:	50,000

PHASE SHIFT WITH CHANGE IN ATTENUATION:

1° per dB x f(GHz) maximum

POWER RATING: 5 watts **average** to 25 °C ambient temperature, derated linearly to 0 watts @ 85 °C.
500 watts **peak** (5 μsec pulse width; 0.5 % duty cycle).

Models 940-60 & 940-114 Continuously Variable Attenuators

SPECIFICATIONS (Con't)

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.001 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 °C to +85 °C
Nonoperating:	-55 °C to +125 °C.

FREQUENCY SENSITIVITY:

Model 940-60:	0.05 x A x (F - Fd) dB
Model 940-114:	0.1 x A x (F - Fd) dB

A = Attenuation setting in dB
Fd = Dial cut frequency in GHz
F= Operation frequency in GHz

CALIBRATION: Test data is available at additional cost.

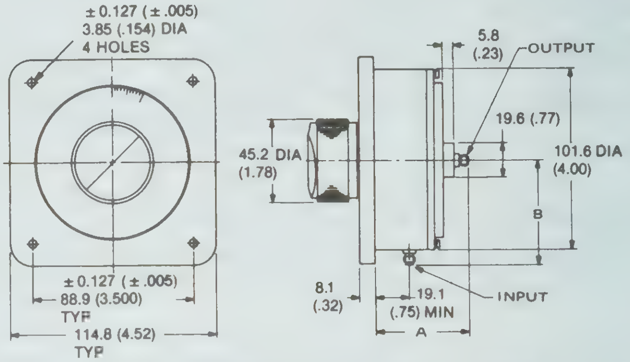
CONNECTORS: SMA or Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	INPUT (J1)	OUTPUT (J2)
11	SMA, Female	SMA, Female
12	SMA, Female	SMA, Male
22	SMA, Male	SMA, Male
33	N, Female	N, Female
34	N, Female	N, Male
44	N, Male	N, Male

CONSTRUCTION: Aluminum body and stainless steel connectors; gold plated beryllium copper contacts. Knob is included with each unit.

WEIGHT: Net 1,570 g (3 lbs, 8 oz)

PHYSICAL DIMENSIONS:



Model No.	DIM A	DIM B
940-XX-11	52.3 (2.06)	58.2 (2.29)
940-XX-12	55.6 (2.19)	58.2 (2.29)
940-XX-22	55.6 (2.19)	61.5 (2.42)
940-XX-33	61.0 (2.40)	68.1 (2.68)
940-XX-34	66.0 (2.60)	68.1 (2.68)
940-XX-44	66.0 (2.60)	71.9 (2.83)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

940 - 114 - 11 - *

Basic Model Number	Attenuation Value (dB)	Connector Options 1st digit is input side 2nd digit is output side

ACCESSORIES

ATTENUATOR STAND, MODEL 940 Z: This stand allows a user to easy mount any Model 940 for those bench applications.

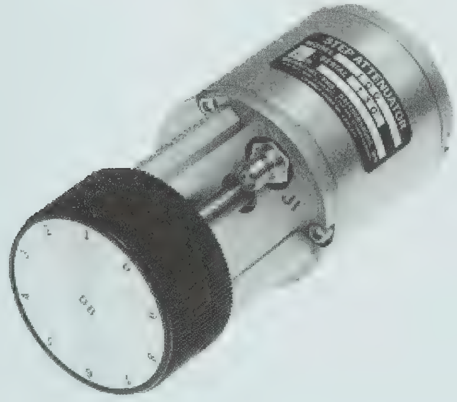
U.S. Patent No. 3,260,971

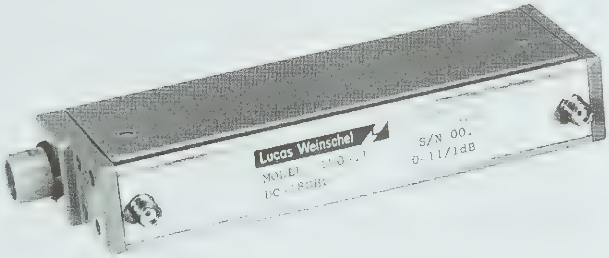
Step Attenuators
(Manual, Motorized & Programmable)

GENERAL INFORMATION

Lucas Weinschel offers a wide selection of Step Attenuators available in manual, motorized and programmable models. Outstanding features of Lucas Weinschel step attenuators are:

* **Long Life**
* **High Reliability**
* **Choice of Standard Attenuation Ranges -** Lucas Weinschel offers a selection of different attenuation ranges to select from. These range from 0 to 9 dB in 1 dB steps up to 0 to 140 dB in 10 dB steps.
* **Stability** - The resistive elements used in these Step Attenuators provide long-term stability over temperature and humidity.
* **Quality Connectors** - Lucas Weinschel Step Attenuators are supplied with stainless steel Type N or SMA connectors that mate non-destructively with connectors per MIL-C-39012.
* **Broadband** - The Lucas Weinschel Precision Step Attenuator line provides a wide selection of frequency ranges from dc to 40 GHz.
* **Product Uniformity** - High volume fabrication techniques, including injection molding, stamping, broaching and thick film printing ensure a cost effective and uniform product.





In this section of the catalog, each Step Attenuator is outlined ultilizing individual data sheets containing product features, specifications, and outline drawings. These data sheets are preceded by a quick reference guide to help you select the Step Attenuator(s) that fits your needs. The page number for each Step Attenuator data sheet is given in the quick reference guide.

APPLICATIONS

The applications for step attenuators are primarily in areas demanding broadband accuracy with low SWR and accurate repeatability over large attenuation ranges. The Lucas Weinschel Step Attenuators utilize the excellent performance characteristics of the Lucas Weinschel fixed coaxial attenuators. The Lucas Weinschel step attenuators are widely used in many types of ATE and OEM systems operating throughout the world.

Step Attenuator Quick-Reference Guide

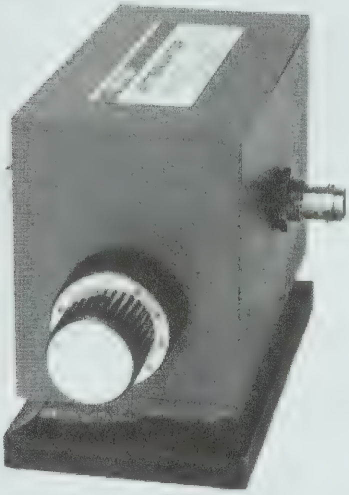
Model Number	Attenuator Type	Connector Type	Frequency Range (GHz)	Incremental Attenuation Range (dB)	Insertion Loss (dB)	Average Power (Watts)	Peak Power (kW)	Maximum Repeatability (±)	SWR[1]	Page No.
3050	Manual	BNC,N	dc-1.25	0-110 dB in 10 dB steps[2]	0.6-1.0[3]	1	100	0.1 dB	1.20-1.30	45
3051			dc-2.0							
100	Manual	3.5mm	dc-26.5	0.9 dB in 1 dB steps	1.5	2	200	0.05 dB	1.60	47
102			dc-26.5	0-90 dB in 10 dB steps				0.3 dB	1.75	
101	Motorized	3.5mm	dc-26.5	0-9 dB in 1 dB steps	1.5	2	200	0.05 dB	1.60	49
103				0-90 dB in 10 dB steps				0.1 dB	1.75	
104	Motorized	2.92 mm	dc-40	0-60 dB in 10 dB steps	2.5	1	100	0.05	1.6-2.0	51
3003	Manual	SMA	dc-2.5	0-70 dB in 10 dB steps	0.3	1	100	0.1 dB	1.20	53
3006	Manual	SMA	dc-1.25	0-100 dB in 10 dB steps	0.2	1	100	0.1 dB	1.20	
3007	Manual	SMA	dc-2.5	0-10 dB in 1 dB steps	0.3	1	100	0.1 dB	1.30	
3010	Manual	SMA	dc-2.5	0-70 dB in 1 dB steps	0.7	1	100	0.1 dB	1.35	
3014	Manual	SMA	dc-1.25	0-110 dB in 1 dB steps	0.5	1	100	0.1 dB	1.30	
9009	Manual	SMA	dc-18.0[2]	9 dB in 1 dB steps	0.3-1.0[1]	2	200	0.05 dB	1.25-1.60	56
9003	Manual	SMA	dc-18.0[2]	69 dB in 1 dB steps	0.6-1.5[1]	2	200	0.05 dB /drum	1.35-1.75	
9004	Manual	SMA	dc-18.0[2]	99 dB in 1 dB steps	0.6-1.5[1]	2	200	0.05 dB /drum	1.35-1.75	
9010	Manual	SMA	dc-18.0[2]	0-60 dB in 10 dB steps	0.4-1.0[1]	2	200	0.05 dB	1.25-1.60	
9011	Manual	SMA	dc-18.0[2]	0-90 dB in 10 dB steps	0.5-1.0[1]	2	200	0.05 dB	1.25-1.60	
115A	Manual	SMA/N TNC/GPC7	dc-18.0[2]	0-9 dB in 1 dB steps	0.3-1.0[1]	2	200	0.05 dB	1.20-1.60	59
116A	Manual	SMA/N TNC/GPC7	dc-18.0[2]	0-60 dB in 10 dB steps	0.3-1.0[1]	2	200	0.05 dB	1.20-1.60	
117A	Manual	SMA/N TNC/GPC7	dc-18.0[2]	0-69 dB in 1 dB steps	0.5-1.5[1]	2	200	0.05 dB	1.25-1.70	
118A	Manual	SMA/N TNC/GPC7	dc-18.0[2]	0-90 dB in 10 dB steps	0.5-15[1]	2	200	0.05 dB	1.20-1.60	
119A	Manual	SMA/N TNC/GPC7	dc-18.0[2]	0-99 dB in 1 dB steps	0.5-1.5[1]	2	200	0.05 dB	1.25-1.70	
3200 Series	Programmable (nonlatching)	SMA	dc-2.0	0.127 in 1 dB steps	2.25-4.75[1]	1	50	0.001 dB per cell	1.25-1.35	63
3220 Series	Programmable (latching)	SMA	dc-2.0	0.127 in 1 dB steps	1.75-4.25[1]	1	50	0.001 dB per cell	1.25-1.35	67
144 Series	Binary Step	SMA	dc-18[2]	0-110 dB in 10 dB steps	1.0-2.4[1]	2	500	0.04 dB per cell	1.40-1.90	70
150 Series	Programmable (latching)	SMA	dc-26.5[2]	0-110 dB in 10 dB steps	2.2	1	100	0.01 dB	1.70	73
8300-1	Programmable (Level Set)	Type N	dc-2	127 dB in 1 dB steps	3.0-5.25	1	50	0.06 dB (typ)	1.25-1.35	80
8300-2	Programmable (Level Set)	SMA	dc-18	121 dB in 1 dB steps	8.0-12.0[4]	1	100	0.03 dB (typ)	1.25-1.85	
8300-3	Programmable (Level Set)	SMA	dc-26.5	90 dB in (10 dB steps)	8.0-14.0[4]	1	100	0.1 dB (max)	1.25-1.80	

1. Varies with frequency.
2. Other ranges and increments available refer to data sheet.
3. Varies with Model.
4. With 3 dB internal masking at each port.

Model 3050 dc to 2.0 GHz
Model 3051 dc to 1.25 GHz
COAXIAL BENCH STEP ATTENUATORS

1 WATT

BNC or Type N Connectors



FEATURES

- **Choice of Attenuation Ranges and Steps** - Three standard ranges and steps from 0 to 10 dB/1 dB and 0 to 110 dB/1 dB steps
- **Excellent Repeatability** - Better than 0.1 dB over frequency range and switching life.
- **Connector Options** - Choice between BNC female and Type N female connectors.

DESCRIPTION

Lucas Weinschel's Bench Attenuators, Series 3050 and 3051 are designed for the precision control of signal levels in the dc to 1.25/2 GHz frequency range.

These attenuators use standard Lucas Weinschel 3000 series OEM attenuators as the attenuating device, while providing suitable packaging and connector configurations for bench applications. The 3050 Series is a single-drum unit, and the 3051 Series is a dual-drum unit with concentric shafts.

A Lucas Weinschel patented detent mechanism tested to over 1,000,000 operations at +65 °C adds to the dependability, even down to -40 °C. Use of patented resistive elements on ceramic substrates provide not only a uniquely flat frequency response, but consistency of performance.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE:

Model 3050-10:	dc to 2 GHz
Model 3050-100:	dc to 1.25 GHz
Model 3051-110:	dc to 1.25 GHz

ATTENUATION RANGE AND STEP INCREMENTS:

Model 3050-10:	10 dB/1 dB
Model 3050-100:	100 dB/10 dB
Model 3051-110:	110 dB/1 dB

ATTENUATION ACCURACY:

Model No.	ACCURACY
3050-10	± 0.3 dB
3050-100	± 0.3 dB or 1 % (up to 60 dB) ± 2 % (60 to 100 dB)
3051-110	± 0.3 dB (up to 10 dB) ± 0.3 dB or 1 % (10 to 60 dB) ± 2 % (60 to 100 dB)

ZERO INSERTION LOSS:

Model 3050-10	< 0.6 dB
Model 3050-100	< 1.0 dB
Model 3051-110	< 1.0 dB

MAXIMUM SWR:

Model No.	SWR
3050-10	1.25
3050-100	1.20
3051-110	1.30

INCREMENTAL PHASE SHIFT: 0.25° per dB x f(GHz)

POWER COEFFICIENT: < 0.006 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

SPECIFICATIONS (Con't)

POWER RATING: 1 watts **average** @ 25 °C ambient temperature, derated linearly to 0 watts @ 65 °C.
100 watts **peak** (5 µsec pulse width; 0.5 % duty cycle)

SWITCHING LIFE: 1,000,000 steps

REPEATABILITY: ± 0.1 dB over frequency range and switching life.

TEMPERATURE RANGE:

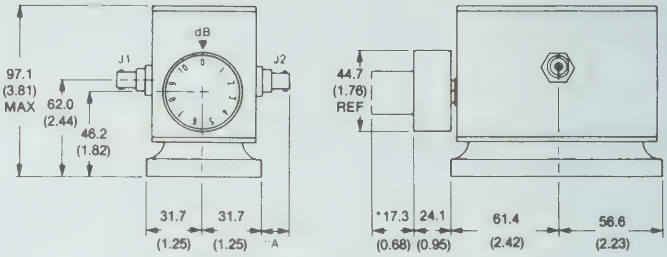
Operating:	-40 °C to +65 °C
Nonoperating:	-54 °C to +85 °C

CONNECTORS: BNC female or Type N female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
88	BNC, Female
33	Type N, female

WEIGHT: Net 880 g (1 lb, 15 oz)

PHYSICAL DIMENSIONS:



CONN TYPE	DIM A
BNC	18.0 (0.71)
Type N	19.6 (0.77)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

3050 - 10 - 88

Basic Model Number	Attenuation Value (dB)	Connector Options

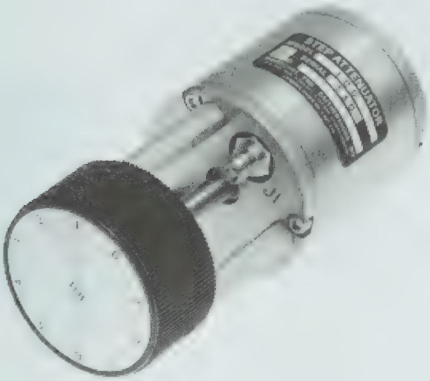
U.S. Patents 4,107,634, 4,107,633

Model 100 & 102
MANUAL STEP ATTENUATORS

dc to 26.5 GHz

2 WATTS

3.5 mm Connectors



FEATURES

- **Choice of Attenuation Ranges and Steps**
- **Low RF Leakage** - 80 dB below input signal.
- **High Reliability** - Contact mechanism which exceeds the requirements of MIL-A-24215. This provides useful life beyond 1,000,000 operations.
- **Stable Connectors**- Molded captive inner contact/bead assembly provides controlled and stable dimensions.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

INCREMENTAL ATTENUATION RANGE/STEPS:

Model 100:	0-9 dB in 1 dB steps
Model 102:	0-90 dB in 10 dB steps

INCREMENTAL INSERTION LOSS ACCURACY:

MODEL NO.	ACCURACY
100	± 0.75 dB
102	± 1.5 dB or 2 %

MAXIMUM SWR:

Frequency (GHz)	SWR
dc - 18	1.60
18 - 26.5	1.75

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

dc-18 GHz:	1.0 dB maximum
18-26.5 GHz:	1.5 dB maximum

INCREMENTAL PHASE SHIFT WITH CHANGE IN ATTENUATION:

~0.25° per dB x f(GHz)

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 54 °C.
200 watts **peak** (5 μsec pulse width; 0.5 % duty cycle)

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 °C to + 54 °C
Nonoperating:	-54 °C to + 54 °C

CALIBRATION: Insertion loss and SWR data supplied at dc, 4.0, 8.0, 12.0, 18.0 and 26.5 GHz. Other test data can be provided at additional cost.

REPEATABILITY: ± 0.05 dB (0 to 60 dB)
± 0.3 dB (70 to 90 dB)

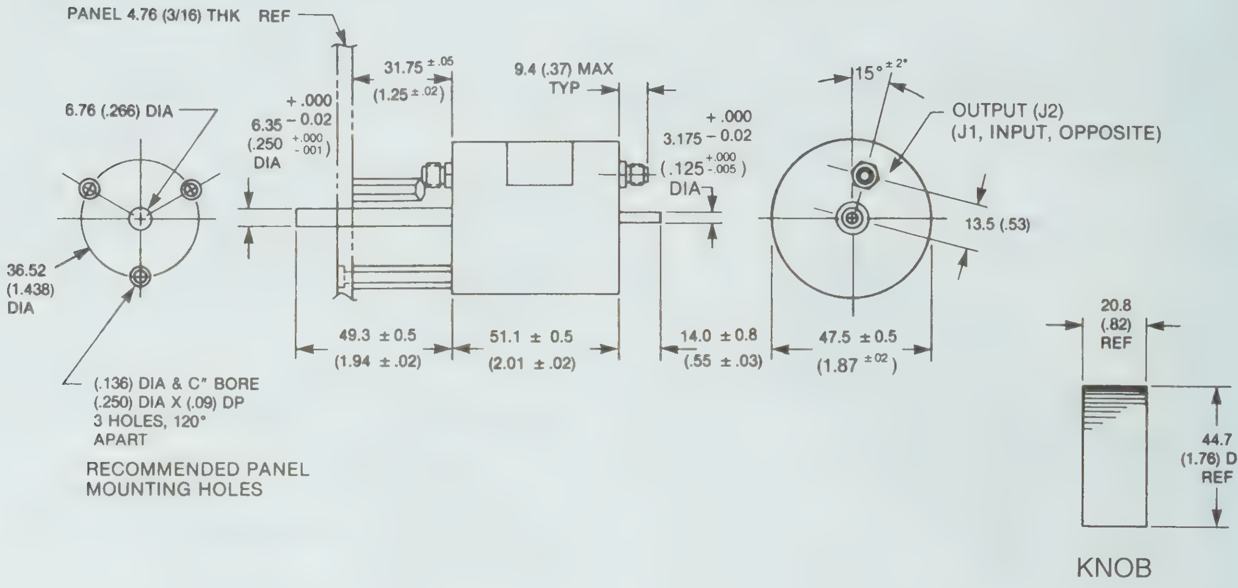
CONNECTORS: 3.5 mm female connectors - mate nondestructively with SMA connectors per MIL-C-39012 and other 3.5 mm and 2.92 mm connectors.

CONSTRUCTION: Stainless steel connectors; gold plated beryllium copper contacts. Knob is included with each unit.

WEIGHT: Net 270 g (9.6 oz)

Models 100 & 102 Manual Step Attenuators

PHYSICAL DIMENSIONS:


PANEL 4.76 (3/16) THK REF
6.76 (.266) DIA
36.52 (1.438) DIA
(.136) DIA & C" BORE (.250) DIA X (.09) DP 3 HOLES, 120° APART
RECOMMENDED PANEL MOUNTING HOLES
6.35 +.000 −0.02 (.250 +.000 −.001) DIA
31.75 ±.05 (1.25 ±.02)
9.4 (.37) MAX TYP
3.175 +.000 −0.02 (.125 +.000 −.005) DIA
49.3 ± 0.5 (1.94 ± .02)
51.1 ± 0.5 (2.01 ± .02)
14.0 ± 0.8 (.55 ± .03)
47.5 ± 0.5 (1.87 ±.02)
15° ±2°
OUTPUT (J2) (J1, INPUT, OPPOSITE)
13.5 (.53)
20.8 (.82) REF
44.7 (1.76) DIA REF
KNOB

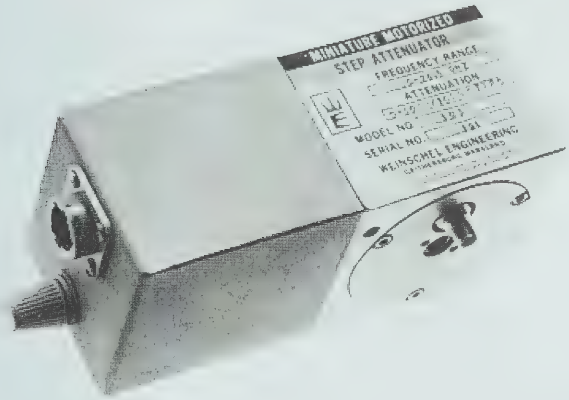
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Models 101 & 103
MOTORIZED STEP ATTENUATORS

dc to 26.5 GHz

2 WATTS

3.5 mm Connectors



FEATURES

- **Choice of Attenuation Ranges and Steps**.
- **Low RF Leakage** - 80 dB below input signal
- **High Reliability** - Contact mechanism which exceeds the requirements of MIL-A-24215 providing useful life beyond 1,000,000 operations
- **Self-Contained Control Circuit** - Both models can be configured for shortest path, non-zero crossing, or on-command operations (Jumper Selected).

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

INCREMENTAL ATTENUATION RANGE/STEPS:

Model 101:	0-9 dB in 1 dB steps
Model 103:	0-90 dB in 10 dB steps

INCREMENTAL INSERTION LOSS ACCURACY:

MODEL NO.	ACCURACY
101	± 0.75 dB
103	± 1.5 dB or 2 %

MAXIMUM SWR:

Frequency (GHz)	SWR
dc - 18	1.60
18 - 26.5	1.75

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

dc-18 GHz:	1.0 dB maximum
18-26.5 GHz:	1.5 dB maximum

INCREMENTAL PHASE SHIFT WITH CHANGE IN ATTENUATION:

~0.25 per dB x f(GHz)

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 54 °C.
200 **watts** peak (5 msec pulse width; 0.5 % duty cycle)

POWER COEFFICIENT: <0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 °C to +54 °C
Non-Operating:	-54 °C to +54 °C.

CALIBARATION: Insertion loss and SWR data supplied at dc, 4.0, 8.0, 12.0, 18.0 and 26.5 GHz. Other test data can be provided at additional cost.

REPEATABILITY: ± 0.05 dB to 60 dB
± 0.1 dB to 90 dB

SWITCHING METHOD: dc gear motor, TTL BCD programming

SWITCHING SPEED:

Shortest Path: 1.25 seconds maximum, 1 second typical, between adjacent positions: 250 milliseconds maximum, 200 milliseconds typical

Non Zero Crossing: 2.5 seconds maximum, 2 seconds typical, between adjacent positions: 250 milliseconds maximum, 200 millisecond typical

On Command Operation: 2.5 seconds maximum, 2 seconds typical, between adjacent positions: 250 milliseconds maximum, 200 millisecond typical

MOTOR POWER: + 28 V (± 10%), 200 mA

SPECIFICATIONS (Con't)

CONNECTORS: 3.5 mm connectors - mate nondestructively with SMA connectors per MIL-C-39012 and other 3.5 mm and 2.92 mm connectors.

Connector Options	Type/Description
1	SMA, Female
2	SMA, Male

WEIGHT: Net 870 g (1 lb, 13 oz)

ACCESSORIES:

CONTROL CONNECTOR WIRING: Lucas Weinschel offers a 10 ft Interconnect cable (P/N 101-1428) with mating control connector so that the Model 101 or 103 can be wired into any application or user setup. If the interconnect cable is not required a Control Connector Kit can be ordered using P/N 101-1534.

MODEL NUMBER DESCRIPTION:

Example

101 - 12

Basic Model Number

Connector Options

U.S. Patent No. 4,431,255; 3,550,046; 3,157,846; 3,260,971; 3,228,099

PHYSICAL DIMENSIONS:

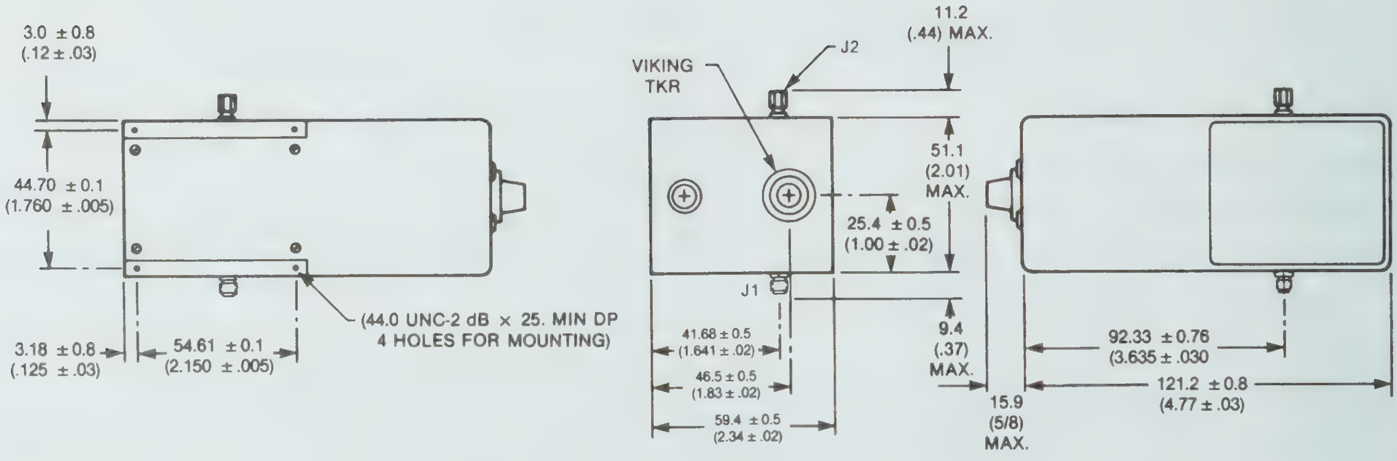
Input Data: Negative Binary Coded Decimal (BCD) on pins 16, 17, 18, and 19.

Unit Operation:

Shortest Path: Connect pin 1 to pin 3.

Non zero crossing: Connector pin 1 to pin 2.

On commmand operations: As supplied drum will always run in the decreasing attenuation direction to selected position. Connect pin 1 to pin 12 (GND) and drum will always run in increasing attenuation to selected position


3.0 ± 0.8
(.12 ± .03)
44.70 ± 0.1
(1.760 ± .005)
3.18 ± 0.8
(.125 ± .03)
54.61 ± 0.1
(2.150 ± .005)
(44.0 UNC-2 dB × 25. MIN DP
4 HOLES FOR MOUNTING)
VIKING
TKR
J2
J1
11.2
(.44) MAX.
51.1
(2.01)
MAX.
25.4 ± 0.5
(1.00 ± .02)
9.4
(.37)
MAX.
41.68 ± 0.5
(1.641 ± .02)
46.5 ± 0.5
(1.83 ± .02)
59.4 ± 0.5
(2.34 ± .02)
15.9
(5/8)
MAX.
92.33 ± 0.76
(3.635 ± .030
121.2 ± 0.8
(4.77 ± .03)

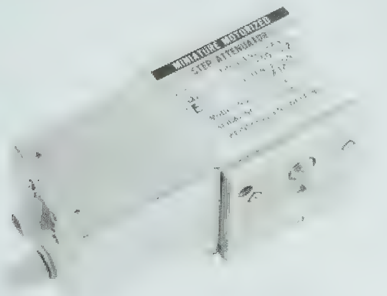
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 104
MOTORIZED STEP ATTENUATOR

dc to 40.0 GHz

1 WATT

Rugged 2.92 mm Connectors



FEATURES

- * **High Reliability** - Contact mechanism which exceeds the requirements of MIL-A-24215 providing useful life beyond 1,000,000 operations
- * **Self-Contained Control Circuit** - Model 104 can be configured for shortest path, non-zero crossing, or on-command operations (Jumper Selected).

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 40 GHz

INCREMENTAL ATTENUATION RANGE/STEPS:

0-60 dB in 10 dB steps

INCREMENTAL INSERTION LOSS ACCURACY:

± 1.5 dB or 3% (whichever is greater)

MAXIMUM SWR:

Frequency (GHz)	SWR
dc - 18	1.60
18 - 26.5	1.75
26.5 - 40	2.00

CHARACTERISTIC INSERTION LOSS, RESIDUAL:

Typically 2.0 dB

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 °C to +54 °C
Non-Operating:	-54 °C to +54 °C

LIFE EXPECTANCY: 1,000,000 steps

REPEATABILITY: ± 0.02 dB maximum

SWITCHING METHOD: DC gear motor, TTL command BCD programming

SWITCHING SPEED:

Shortest Path: 1.25 seconds maximum, 1 second typical, between adjacent positions: 250 milliseconds maximum, 200 milliseconds typical

Non Zero Crossing: 2.5 seconds maximum, 2 seconds typical, between adjacent positions: 250 milliseconds maximum, 200 millisecond typical

On Command Operation: 2.5 seconds maximum, 2 seconds typical, between adjacent positions: 250 milliseconds maximum, 200 millisecond typical

MOTOR POWER: + 28 V (± 10%), 300 mA

POWER RATING: 1 watts **average** to 25 °C ambient temperature, derated linearly to 0.5 watts @ 54 °C. 100 watts **peak** (5 msec pulse width; 0.5 % duty cycle)

CALIBRATION: Insertion loss and SWR data supplied at dc, 6.0, 8.0, 12.0, 18.0, 26.5 and 40 GHz. Other test data can be provided at additional cost.

CONNECTORS: 2.92 mm connectors - mate nondestructively with SMA connectors per MIL-C-39012 and other 2.92 mm connectors.

Connector Options	Type/Description
1	2.92 mm, Female
2	2.92 mm, Male

WEIGHT: Net 870 g (1 lb 13 oz)

ACCESSORIES:

CONTROL CONNECTOR WIRING: Lucas Weinschel offers a 10 ft Interconnect cable (P/N 101-1427) with mating control connector so that the Model 101 or 103 can be wired into any application or user setup. If the interconnect cable is not required a Control Connector Kit can be ordered using P/N 101-1534-1.

MODEL NUMBER DESCRIPTION:

Example

104 - 12

Basic Model Number

Connector Options

Model 104
Motorized Step Attenuator

PHYSICAL DIMENSIONS:

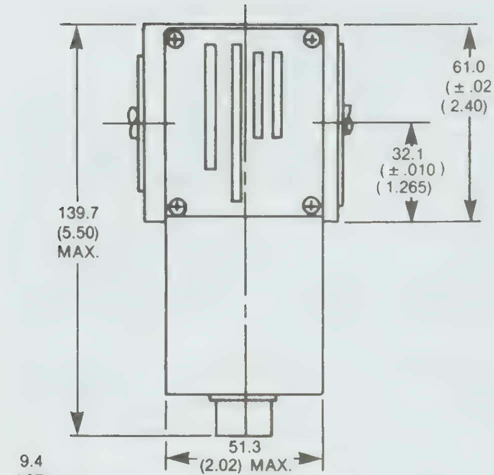
Input Data: Negative Binary Coded Decimal (BCD) on pins 4, 5, 6, 7.

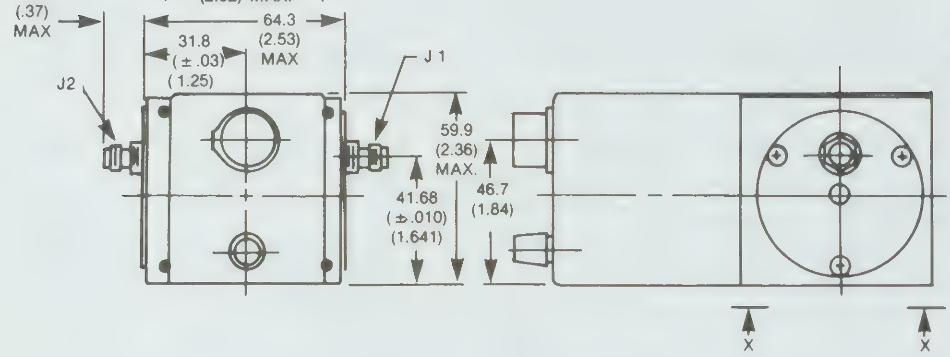
Unit Operation:

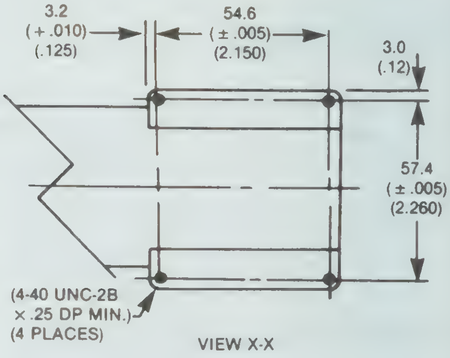
Shortest Path: Connect pin 1 to pin 3.

Non zero crossing: Connector pin 1 to pin 2.

On commmand operations: As supplied drum will always run in the decreasing attenuation direction to selected position. Connect pin 1 to pin 12 (GND) and drum will always run in increasing attenuation to selected position.


61.0
(± .02)
(2.40)
32.1
(± .010)
(1.265)
139.7
(5.50)
MAX.
51.3
(2.02) MAX.


9.4
(.37)
MAX
64.3
(2.53)
MAX
31.8
(± .03)
(1.25)
J2
J 1
59.9
(2.36)
MAX.
41.68
(±.010)
(1.641)
46.7
(1.84)
X
X


3.2
(+.010)
(.125)
54.6
(± .005)
(2.150)
3.0
(.12)
57.4
(± .005)
(2.260)
(4-40 UNC-2B
× .25 DP MIN.)
(4 PLACES)
VIEW X-X

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Models 3003, 3006, 3007, 3010, & 3014

STEP ATTENUATORS FOR OEM

dc to 2.5 GHz
1 WATT

Rugged SMA Female Connectors

FEATURES

- **High Reliability** - Repeatability better than 0.1 dB over frequency range and life. Lucas Weinschel patented detent mechanism, tested to 1,000,000 operations at +75 ˚C, operates dependably even down to -40 ˚C.
- **Product Uniformity** - High volume fabrication techniques, including injection molding, stamping, broaching and thick film printing ensure a cost effective and uniform product.
- **Low Frequency Sensitivity** - Typically 0.1 to 0.2 dB up to 2.5 GHz.
- **Shock Resistant** - 100% spring contact system withstands mechanical and thermal shock and eliminates the need for epoxy or solder.
- **Wide Selection** - Wide choice of attenuation ranges and increments in standard stock models. Single and dual drum configurations available.
- **Knob Included** - Knobs for both single and dual drum models are included with every attenuator. Characters are screened on the face of the knob insert which is coated with a clear layer of epoxy for protection.

SPECIAL CONFIGURATIONS: Some modifications to the basic configuration of the 3000 Series can be made during manufacturing. Examples of these special configurations are shafts having special lengths and ends; clockwise shaft rotation; modified mounting arrangements; and provisions for add-on items such as concentric potentiometers and ganged switches.

OPTIONS: Lucas Weindschel offers Model 3000 Step Attenuators with three low-cost options which we think can be useful in certain applications. Add option number to the basic model number when ordering.

Option-100: **STANDARD MODEL NO. OPTIONS.**

Option-103: **PANEL SEAL** - For single-drum models only, sealing the attenuator to a panel is achieved by use of an "O" ring around the control shaft and seal screws to mount the unit to the panel. Both the "O" ring and seal screws are provided with this option. (A dual-drum panel seal option is not available.)

Option-120: **INDICATOR SWITCH** - A single-pole, rotary switch ganged mechanically with the attenuator drum is available to provide a closure for indicating drum position (value of attenuation). The switch has a life of 1,000,000 operations and is suitable for use in controlling digital-logic circuits.

Option-123: **INDICATOR SWITCH/PANEL SEAL** - This option inculdes both the indicator switch and panel seal option listed above.

U.S. Patent No. 4,107,634; 4,107,633

Models 3003, 3006, 3007, 3010 & 3014

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE:

Models 3006, 3014:	dc to 1.25 GHz
Models 3003, 3007, 3010	dc to 2.5 GHz

INCREMENTAL ATTENUATION RANGE/STEPS:

Model 3003:	0-70 dB in 10 dB steps
Model 3006:	0-100 dB in 10 dB steps
Model 3007:	0-10 dB in 1 dB steps
Model 3010:	0-70 dB in 1 dB steps
Model 3014:	0-110 dB in 1 dB steps

POWER COEFFICIENT: < 0.006 dB/dB/watt

TEMPERATURE COEFFICIENT: 0.0004 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	-40 °C to +65 °C
Non-Operating:	-54 °C to +85 °C

POWER RATING: 1 watts **average** @ 25 °C ambient temperature, derated linearly to 0 watts @ 65 °C. 100 watts **peak** (5 µsec pulse width; 0.5 % duty cycle)

ATTENUATION ACCURACY:

MODEL NO.	ACCURACY
3003	± 0.3 dB or 1 % (up to 60 dB) ± 2 % (60 to 70 dB)
3006	± 0.3 dB or 1 % (up to 60 dB) ± 2 % (60 to 100 dB)
3007	± 0.3 dB
3010	± 0.3 dB (up to 10 dB) ± 0.3 dB or 1 % (10 to 60 dB) ± 2 % (60 to 70 dB)
3014	± 0.3 dB (up to 10 dB) ± 0.3 dB or 1 % (10 to 60 dB)

CONNECTORS: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

SHAFT ROTATION: counter clockwise for increasing attenuation

STEP ANGLE: 32.7 °

DRUM CONFIGURATIONS:

Single Drum:	3003, 3006, 3007
Dual Drum:	3010, 3014

SWITCHING LIFE: 1,000,000 steps

REPEATABILITY: ± 0.1 dB over frequency range and rated life

ROTATION STOPS: Supplied on 10 dB step drums (not supplied on 1 dB drums).

MAXIMUM SWR AND INSERTION LOSS:

MODEL NO.	SWR	INS LOSS
3003	1.20	0.3 dB
3006	1.20	0.2 dB
3007	1.30	0.3 dB
3010	1.35	0.7 dB
3014	1.30	0.5 dB

INCREMENTAL PHASE SHIFT: ~0.25° per dB x f(GHz)

CONSTRUCTION: Shafting and external hardware and connector shells: CRES Type 303, per ASTM-A582 passivated per QQ-P-35. Housing: AL ALLOY Gold Flash. Knob is included with each unit.

CALIBRATION: Test data is available at additional cost.

WEIGHT:

Single drum:	Net 110 g (4 oz)
Dual drum:	Net 250 g (9 oz)

MODEL NUMBER DESCRIPTION:

Example

3003 - 123

Basic Model Number

Add Dash Number
-100 (standard unit no options)
-103 (panel seal)*
-120 (indicator switch)
-123 (indicator switch and panel seal)*

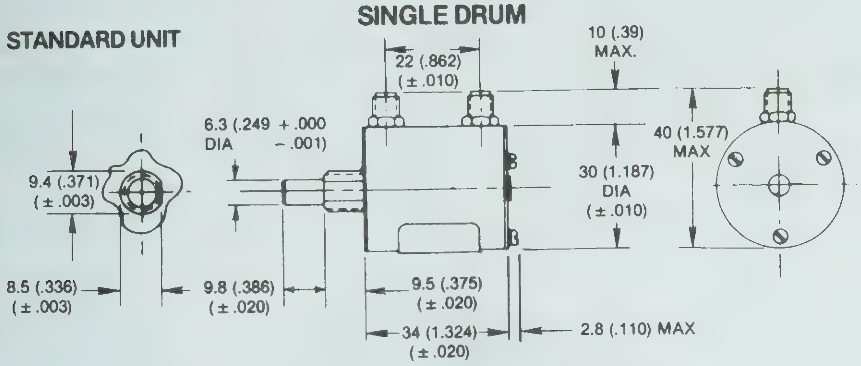
* Single Drum Units only.

Manual Step Attenuators

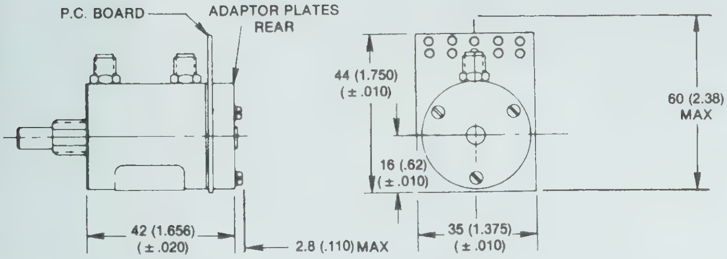
PHYSICAL DIMENSIONS:

SINGLE DRUM

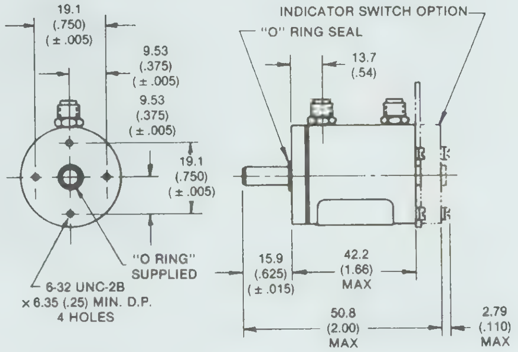
STANDARD UNIT


22 (.862)
(±.010)
10 (.39)
MAX.
6.3 (.249 +.000
DIA −.001)
40 (1.577)
MAX
30 (1.187)
DIA
(±.010)
9.4 (.371)
(±.003)
8.5 (.336)
(±.003)
9.8 (.386)
(±.020)
9.5 (.375)
(±.020)
34 (1.324)
(±.020)
2.8 (.110) MAX

SINGLE DRUM WITH INDICATOR SWITCH OPTION

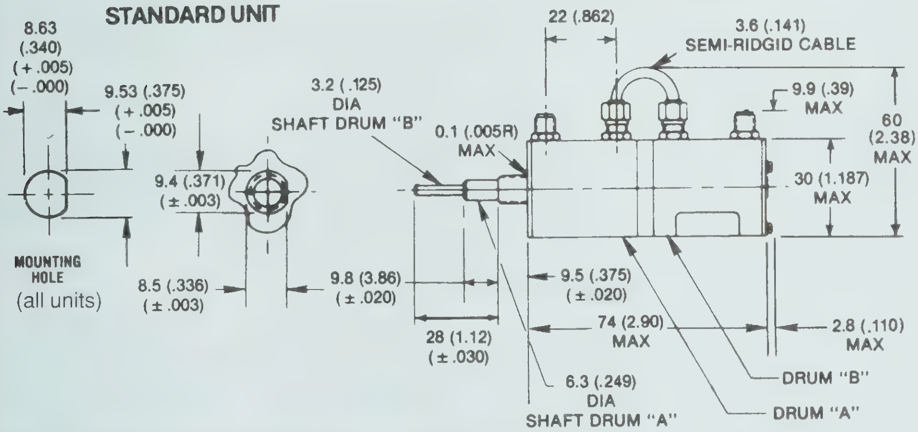

P.C. BOARD
ADAPTOR PLATES
REAR
44 (1.750)
(±.010)
60 (2.38)
MAX
16 (.62)
(±.010)
42 (1.656)
(±.020)
2.8 (.110) MAX
35 (1.375)
(±.010)

SEALED PANEL OPTION


19.1
(.750)
(±.005)
9.53
(.375)
(±.005)
9.53
(.375)
(±.005)
19.1
(.750)
(±.005)
"O RING"
SUPPLIED
6-32 UNC-2B
×6.35 (.25) MIN. D.P.
4 HOLES
INDICATOR SWITCH OPTION
"O" RING SEAL
13.7
(.54)
15.9
(.625)
(±.015)
42.2
(1.66)
MAX
50.8
(2.00)
MAX
2.79
(.110)
MAX

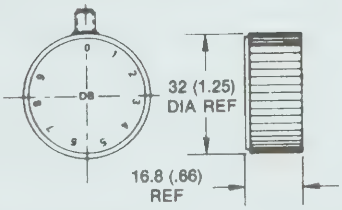
DUAL DRUM

STANDARD UNIT

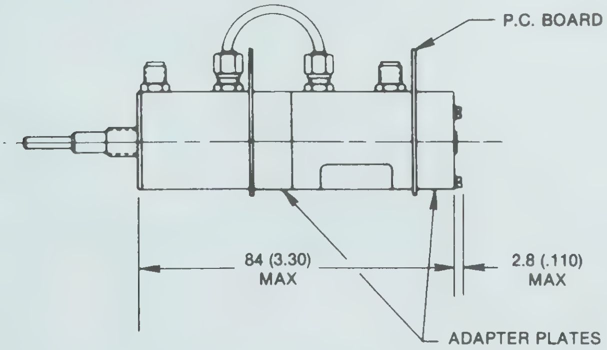

8.63
(.340)
(+.005)
(−.000)
9.53 (.375)
(+.005)
(−.000)
3.2 (.125)
DIA
SHAFT DRUM "B"
0.1 (.005R)
MAX
22 (.862)
3.6 (.141)
SEMI-RIDGID CABLE
9.9 (.39)
MAX
60
(2.38)
MAX
30 (1.187)
MAX
9.4 (.371)
(±.003)
MOUNTING
HOLE
(all units)
8.5 (.336)
(±.003)
9.8 (3.86)
(±.020)
9.5 (.375)
(±.020)
74 (2.90)
MAX
2.8 (.110)
MAX
28 (1.12)
(±.030)
6.3 (.249)
DIA
SHAFT DRUM "A"
DRUM "B"
DRUM "A"

KNOBS

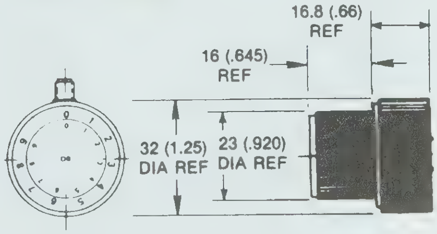
SINGLE DRUM


0
1
2
3
4
5
6
7
8
9
DB
32 (1.25)
DIA REF
16.8 (.66)
REF

DUAL DRUM WITH INDICATOR SWITCH OPTION


P.C. BOARD
84 (3.30)
MAX
2.8 (.110)
MAX
ADAPTER PLATES

DUAL DRUM

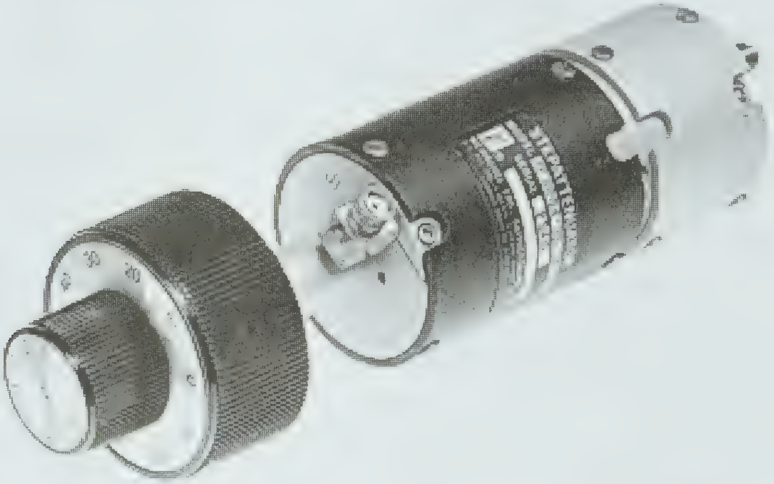

16.8 (.66)
REF
16 (.645)
REF
32 (1.25)
DIA REF
23 (.920)
DIA REF
DB

Models 9003, 9004, 9009, 9010, & 9011

MANUAL STEP ATTENUATORS

dc to 18.0 GHz
2 WATTS

Ruggedized SMA Connectors



FEATURES

* **Broadband** - All models are available in a choice of four frequency ranges: dc to 4, dc to 8, dc to 12.4 and dc to 18 GHz.

* **Wide Choice of Attenuation Ranges** - A choice of five standard attenuation ranges is available: 0 to 9.0, 0 to 69 and 0 to 99 dB in 1 dB steps, and 0 to 60 and 0 to 90 dB in 10 dB steps.

* **Environmental** - Designed to meet most environmental requirements of MIL-A-24215 (Vibration, Shock, Relative Humidity to 95% and Altitude).

* **In-line Configuration** - Passivated stainless steel SMA connectors are set parallel with control shaft (except units with right angle connectors) to reduce volume for applications where space is critical. All models are bidirectional.

* **Improved Incremental Attenuation Accuracy** - Model 9000 series has flat frequency response and small deviation from nominal attenuation at all settings (e.g., deviation is only ± 2.5 dB at 99 dB setting at 18 GHz).

* **Excellent Repeatability and Long Switch Life.**

* **Custom Configurations Available Upon Request.**

* **Highly Accurate Detent Stepping** - Direct drive of attenuator drums eliminates gears and provides for excellent repeatability.

* **Safety Mechanical Stop** - A mechanical stop between maximum and 0 attenuation positions on all models except 0-9 dB unit is provided to prevent large power changes at attenuator output from damaging sensitive equipment.

DESCRIPTION

The Model 9000 series Mini Step Attenuators are broadband miniature step attenuators that provide excellent performance characteristics suitable for use in high reliability 50 ohm systems and applications requiring extra-small components for the precision control of signal levels. The Model 9000 series can be used either as input or output attenuators in signal sources, receivers, field strength meters, spectrum analyzers, etc.

The SMA connectors furnished on all models are available in either standard or right-angle configuration. The sex of front and rear connectors is optional (refer to connector specification for specific combinations available). A knob, marked appropriately, is supplied with each unit.

Models 9003, 9004, 9009, 9010, & 9011 Manual Step Attenuators

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

Frequency Range (add Model No. Prefix to Designate Range):

All Models:	dc to 4.0 GHz (AC)
	dc to 8.0 GHz (AD)
	dc to 12.4 GHz (AE)
	dc to 18.0 GHz (AF)

Standard Incremental Attenuation Range:

Model 9009:	0 to 9 dB in 1 dB step
Model 9003:	0 to 69 dB in 1 dB steps
Model 9004:	0 to 99 dB in 1 dB steps
Model 9010:	0 to 60 dB in 10 dB steps
Model 9011:	0 to 90 dB in 10 dB steps

MAXIMUM SWR:

Frequency Range (GHz)	Models 9009, 9010, 9011	Models 9003, 9004
dc - 4	1.25	1.35
dc - 8	1.35	1.40
dc - 12.4	1.50	1.50
dc - 18	1.60	1.75

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 54 °C.
200 watts **peak** (5 μsec pulse width; 0.5 % duty cycle)

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 °C to + 54 °C
Nonoperating:	-54 °C to +54 °C

CALIBRATION: Insertion Loss data is supplied as follows. Other test data can be supplied at additional cost.

dc to 4 GHz:	At dc and 4 GHz
dc to 8 GHz:	At dc, 4 and 8 GHz
dc to 12.4 GHz:	At dc, 4, 8 and 12 GHz
dc to 18 GHz:	At dc, 4, 8, 12 and 18 GHz

INCREMENTAL PHASE SHIFT: ~0.5 ° per dB per GHz

REPEATABILITY: Better than 0.05 dB across frequency band for switch life

SWITCH LIFE: Over 1,000,000 steps

SHAFT ROTATION: Clockwise for increasing attenuation.

CONSTRUCTION:

Drum Assembly:	Aluminum alloy
Housing:	Phenolic or aluminum
Control Shaft:	Stainless steel
Connectors:	Stainless steel
Knob:	Supplied with control knob

INDEXING: 36 °

MAXIMUM INSERTION LOSS (dB):

Frequency Range (GHz)	Model Number				
	9009	9003	9004	9010	9011
dc - 4	0.3	0.6	0.6	0.4	0.5
4 - 8	0.5	0.8	0.8	0.5	0.6
8 - 12.4	0.7	1.0	1.0	0.7	0.7
12.4 - 18	1.0	1.5	1.5	1.0	1.0

INCREMENTAL INSERTION LOSS (± dB):

Model Number	dB Range	Frequency Range (GHz)			
		dc-4	dc-8	dc-12.4	dc-18
9009	1-9	0.3	0.3	0.3	0.5
9003	1-9	0.3	0.3	0.3	0.5
	10-19	0.7	0.7	0.8	1.0
	20-29	0.9	1.0	1.0	1.2
	30-39	1.0	1.1	1.2	1.4
	40-49	1.1	1.2	1.3	1.5
	50-59	1.2	1.4	1.6	1.7
	60-69	1.3	1.6	1.8	1.9
9004	1-9	0.3	0.3	0.3	0.5
	10-19	0.7	0.7	0.8	1.0
	20-29	0.9	1.0	1.0	1.2
	30-39	1.0	1.1	1.2	1.4
	40-49	1.1	1.2	1.3	1.5
	50-59	1.2	1.4	1.6	1.7
	60-69	1.3	1.6	1.8	1.9
	70-79	1.4	1.7	2.0	2.1
	80-89	1.5	1.9	2.2	2.3
	90-99	1.6	2.0	2.4	2.5
9010	10	0.3	0.4	0.5	1.0
	20	0.3	0.4	0.5	1.0
	30	0.4	0.5	0.6	1.0
	40	0.5	0.6	0.8	1.2
	50	0.7	0.8	1.0	1.5
	60	0.8	0.9	1.2	1.8
9011	10	0.3	0.4	0.5	1.0
	20	0.3	0.4	0.5	1.0
	30	0.4	0.5	0.6	1.0
	40	0.5	0.6	0.8	1.2
	50	0.7	0.8	1.0	1.5
	60	0.8	0.9	1.2	1.8
	70	0.9	1.1	1.4	2.1
	80	1.0	1.2	1.6	2.3
	90	1.2	1.4	1.8	2.5

DRUM CONFIGURATIONS:

Single Drum:	9009, 9010, 9011
Dual Drum:	9003, 9004

SPECIFICATIONS (Con't)

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Front and rear SMA connectors available in either standard or right-angle configuration, connector sex is optional as follows:

Connector Options	Type/Description
1	SMA, Female
2	SMA, Male *
3	SMA, Female, right-angle
4	SMA, Male, right-angle

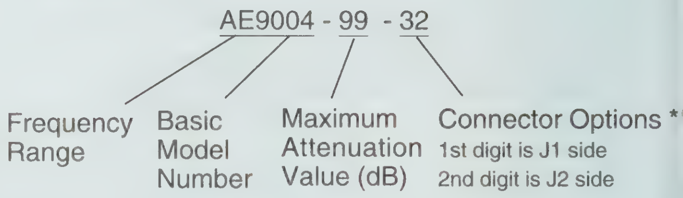
* Standard male SMA connector not available as J1 connector.

WEIGHT:

9009	680 g (2.4 oz)
9010	160 g (5.7 oz)
9011	200 g (7.1 oz)
9003	260 g (9.0 oz)
9004	290 g (10.4 oz)

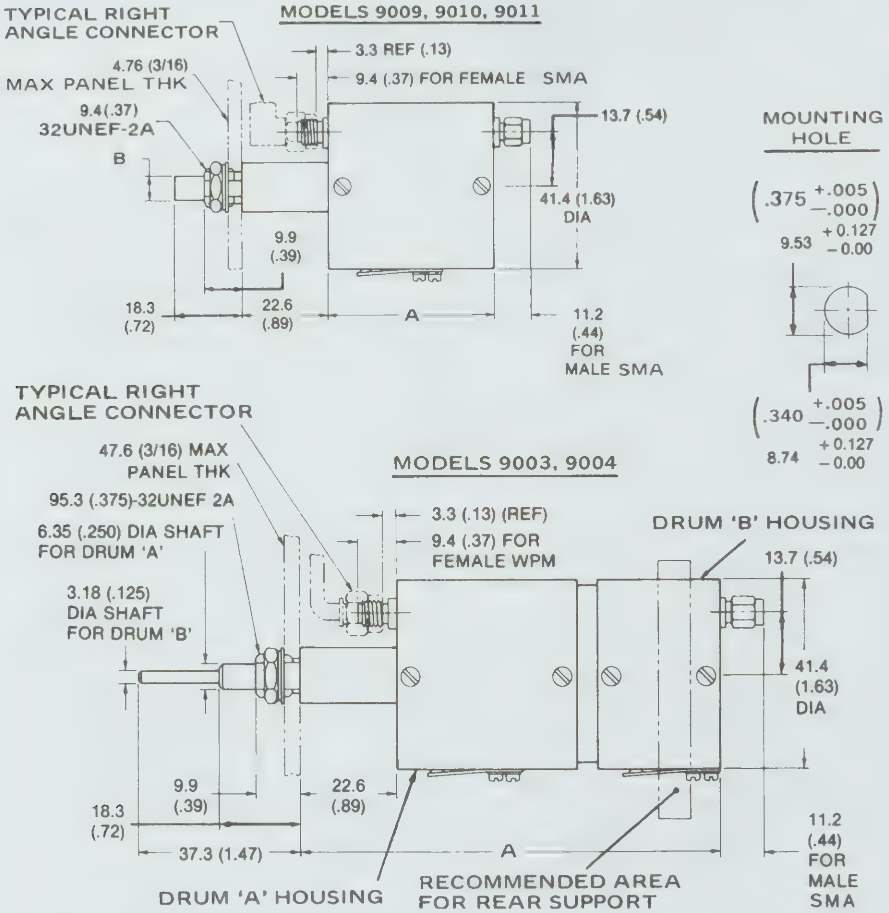
MODEL NUMBER DESCRIPTION:

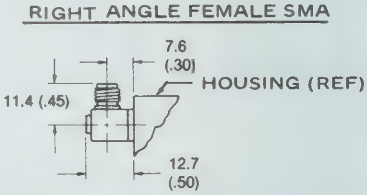
Example

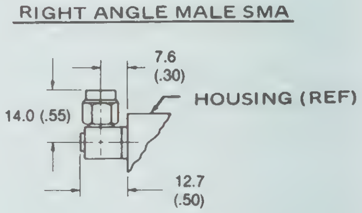

AE9004 - 99 - 32
Frequency Range
Basic Model Number
Maximum Attenuation Value (dB)
Connector Options *
1st digit is J1 side
2nd digit is J2 side

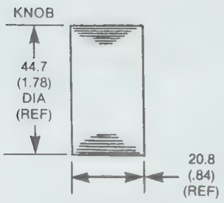
PHYSICAL DIMENSIONS:

Model No.	DIM A	DIM B
9003	96.3 (3.79)	- - -
9004	106.4 (4.19)	- - -
9009	28.7 (1.13)	3.25 (0.125)
9010	41.4 (1.63)	6.35 (0.250)
9011	51.6 (2.03)	6.35 (0.250)


MODELS 9009, 9010, 9011
TYPICAL RIGHT ANGLE CONNECTOR
4.76 (3/16) MAX PANEL THK
9.4 (.37) 32UNEF-2A
B
3.3 REF (.13)
9.4 (.37) FOR FEMALE SMA
13.7 (.54)
41.4 (1.63) DIA
9.9 (.39)
18.3 (.72)
22.6 (.89)
A
11.2 (.44) FOR MALE SMA
MOUNTING HOLE
(.375 +.005 −.000)
9.53 +0.127 −0.00
(.340 +.005 −.000)
8.74 +0.127 −0.00
MODELS 9003, 9004
TYPICAL RIGHT ANGLE CONNECTOR
47.6 (3/16) MAX PANEL THK
95.3 (.375)-32UNEF 2A
6.35 (.250) DIA SHAFT FOR DRUM 'A'
3.18 (.125) DIA SHAFT FOR DRUM 'B'
3.3 (.13) (REF)
9.4 (.37) FOR FEMALE WPM
DRUM 'B' HOUSING
13.7 (.54)
41.4 (1.63) DIA
9.9 (.39)
22.6 (.89)
18.3 (.72)
37.3 (1.47)
A
11.2 (.44) FOR MALE SMA
DRUM 'A' HOUSING
RECOMMENDED AREA FOR REAR SUPPORT

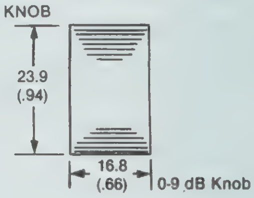

RIGHT ANGLE FEMALE SMA
7.6 (.30)
HOUSING (REF)
11.4 (.45)
12.7 (.50)


RIGHT ANGLE MALE SMA
7.6 (.30)
HOUSING (REF)
14.0 (.55)
12.7 (.50)


KNOB
44.7 (1.78) DIA (REF)
20.8 (.84) (REF)

60 and 90 dB

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

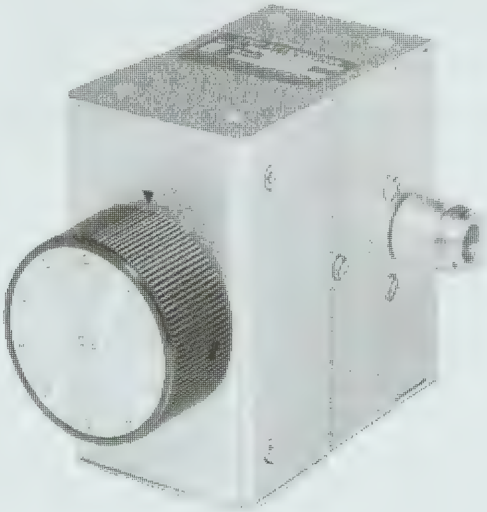

KNOB
23.9 (.94)
16.8 (.66)
0-9 dB Knob

Models 115A thru 119A
MANUAL STEP ATTENUATORS

dc to 18.0 GHz

2 WATTS

Type N, GPC-7, TNC, SMA Connectors



FEATURES

- **Safety Mechanical Stop** - A mechanical stop between maximum and 0 attenuation positions on all models prevents damage to the mechanical drive as well as preventing large power changes that could cause damage to sensitive equipment.
- **Miniature Size** - The Models 115A through 119A are most suitable for applications requiring small components with high performance features, whether it be in systems, laboratory, or production setups.
- **Choice of Attenuation Ranges** - Five standard attenuation ranges are available: 0-9 dB, 0-69 dB, and 0-99 dB in 1 dB steps, and 0-60 dB and 0-90 dB in 10 dB steps.
- **Broadband** - All models are available in a choice of 4 frequency ranges: dc-4, dc-8, dc-12.4, and dc-18 GHz (dc-16 for units with TNC connectors).
- **Right-Angle Drive** - The center conductor of the connectors is perpendicular to the control shaft, offering greater flexibility of applications: panel mounting or bench setup. All models are bidirectional.
- **Custom Configurations Available Upon Request.**
- **Low Deviation from Nominal Value** - These Mini Step Attenuators have flat frequency response over specified bands and excellent attenuation accuracy. Deviation from nominal value is low at all settings.
- **Excellent Repeatability and Long Life Switch** - Repeatability is better than 0.05 dB to 18.0 GHz for over 1,000,000 switchings of the drum.
- **Type N, GPC-7, TNC, or SMA Connectors** - All models available with choice of stainless steel Type N, TNC, SMA, or GPC-7 precision connectors.

DESCRIPTION

The Lucas Weinschel Models 115A through 119A are a series of broadband, miniature Step Attenuators in a right-angle drive configuration, where the center conductor of the connectors is perpendicular to the control shaft. They feature excellent performance characteristics suitable for use in high reliability 50 ohm systems and applications requiring extra-small components for the precision control of power in discrete steps. They can be used either as input or output attenuators in signal sources, receivers, field strength meters, spectrum analyzers, etc.

Models 115A, 116A, 117A, 118A, & 119A

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGES (add Model No. Prefix to Designate Range):

All Models:	dc to 4.0 GHz (AC)
	dc to 8.0 GHz (AD)
	dc to 12.4 GHz (AE)
	dc to 18.0 GHz* (AF)

* dc to 16.0 GHz for TNC connectors

STANDARD INCREMENTAL ATTENUATION RANGE:

Model 115A:	0 to 9 dB in 1 dB steps
Model 116A:	0 to 60 dB in 10 dB steps
Model 117A:	0 to 69 dB in 1 dB steps
Model 118A:	0 to 90 dB in 10 dB steps
Model 119A:	0 to 99 dB in 1 dB steps

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 54 °C. 200 watts **peak** (5 µsec pulse width; 0.5 % duty cycle)

POWER COEFFICIENT: < 0.005/dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004/dB/dB/ °C

TEMPERATURE RANGE:

Operating:	0 to + 54 °C
Nonoperating:	-54 to +54 °C

INCREMENTAL PHASE SHIFT: ~0.5° per dB x f(GHz)

REPEATABILITY: Better than 0.05 dB across frequency band for switch life.

SWITCH LIFE: Over 1,000,000 steps

INDEXING: 36°

MAXIMUM INSERTION LOSS:

Model Number	CONN Type	Frequency Range (GHz)			
		dc-4	dc-8	dc-12.4	dc-18*
115A	N/GPC7	0.3	0.4	0.5	0.7
	SMA/TNC	0.3	0.5	0.7	1.0
116A	N/GPC7	0.3	0.4	0.5	0.7
	SMA/TNC	0.4	0.5	0.7	1.0
117A	N/GPC7	0.5	0.7	0.9	1.2
	SMA/TNC	0.6	0.8	1.0	1.5
118A	N/GPC7	0.4	0.5	0.6	0.8
	SMA/TNC	0.5	0.6	0.7	1.0
119A	N/GPC7	0.5	0.7	0.9	1.2
	SMA/TNC	0.6	0.8	1.0	1.5

* dc to 16.0 GHz with TNC connectors.

INCREMENTAL ATTENUATION ACCURACY (± dB):

Model Number	dB Range	Frequency Range (GHz)			
		dc-4	dc-8	dc-12.4	dc-18*
115A	1-9	0.3	0.3	0.3	0.5
117A	1-9	0.3	0.3	0.3	0.5
	10-19	0.7	0.7	0.8	1.0
	20-29	0.9	1.0	1.0	1.2
	30-39	1.0	1.1	1.2	1.4
	40-49	1.1	1.2	1.3	1.5
	50-59	1.2	1.4	1.6	1.7
	60-69	1.3	1.6	1.8	1.9
119A	1-9	0.3	0.3	0.3	0.5
	10-19	0.7	0.7	0.8	1.0
	20-29	0.9	1.0	1.0	1.2
	30-39	1.0	1.1	1.2	1.4
	40-49	1.1	1.2	1.3	1.5
	50-59	1.2	1.4	1.6	1.7
	60-69	1.3	1.6	1.8	1.9
	70-79	1.4	1.7	2.0	2.1
	80-89	1.5	1.9	2.2	2.3
	90-99	1.6	2.0	2.4	2.5
116A	10	0.3	0.4	0.5	1.0
	20	0.3	0.4	0.5	1.0
	30	0.4	0.5	0.6	1.0
	40	0.5	0.6	0.8	1.2
	50	0.7	0.8	1.0	1.5
	60	0.8	0.9	1.2	1.8
118A	10	0.3	0.4	0.5	1.0
	20	0.3	0.4	0.5	1.0
	30	0.4	0.5	0.6	1.0
	40	0.5	0.6	0.8	1.2
	50	0.7	0.8	1.0	1.5
	60	0.8	0.9	1.2	1.8
	70	0.9	1.1	1.4	2.1
	80	1.0	1.2	1.6	2.3

* dc to 16.0 GHz with TNC connectors.

MAXIMUM SWR (Models 115A, 116A, and 118A):

Frequency Range (GHz)	SMA, N, GPC-7	TNC
dc - 4	1.20	1.30
4 - 8	1.25	1.35
8 - 12.4	1.40	1.50
12.4 - 18	1.50	1.60

* dc to 16.0 GHz with TNC connectors.

SPECIFICATIONS (Con't)

MAXIMUM SWR (Models 117A and 119A):

Frequency Range (GHz)	SMA, N, GPC-7	TNC
dc - 4	1.25	1.35
4 - 8	1.30	1.40
8 - 12.4	1.45	1.55
12.4 - 18*	1.60	1.70

* dc to 16.0 GHz with TNC connectors.

CALIBRATION: Insertion Loss data is supplied as follows. Other test data can be supplied at additional cost.

dc to 4 GHz:	At dc and 4 GHz
dc to 8 GHz:	At dc, 4 and 8 GHz
dc to 12.4 GHz:	At dc, 4, 8 and 12 GHz
dc to 18 GHz:	At dc, 4, 8, 12 and 18 GHz*

* dc to 16.0 GHz with TNC units.

RELATIVE HUMIDITY: 95%

ALTITUDE: to 10,000 ft.

SHOCK (non-operating): 8 g's, 100 ms, 1/2 sine

VIBRATION (non-operating):

5 to 8 cps, 0.20 inch double amplitude
8 to 15 cps, 0.10 inch double amplitude
15 to 55 cps, 0.36 inch double amplitude
Supported rigidly front and back

SHAFT ROTATION: Clockwise for increasing attenuation

CONSTRUCTION:

Materials:	Housing: aluminum alloy, clear irridite, MIL-C-5541.
Dust Cover:	Painted aluminum alloy
Drum:	Aluminum alloy
Shaft:	Passivated stainless steel
Connectors:	Stainless steel and beryllium copper contacts.

DRUM CONFIGURATIONS:

Single Drum:	115A, 116A, 118A
Dual Drum:	117A, 119A

CONNECTORS: SMA, Type N, or TNC connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. GPC-7 connectors mate with other connectors conforming to IEEE-STD-287.

Connector Options	Type/Description
1	SMA, Female
2	SMA, Male
3	Type N, Female
4	Type N, Male
5	GPC 7
6	TNC, Female
7	TNC, Male

WEIGHT:

115A	340 g (12 oz)
116A	340 g (12 oz)
117A	760 g (27 oz)
118A	450 g (16 oz)
119A	880 g (31 oz)

MODEL NUMBER DESCRIPTION:

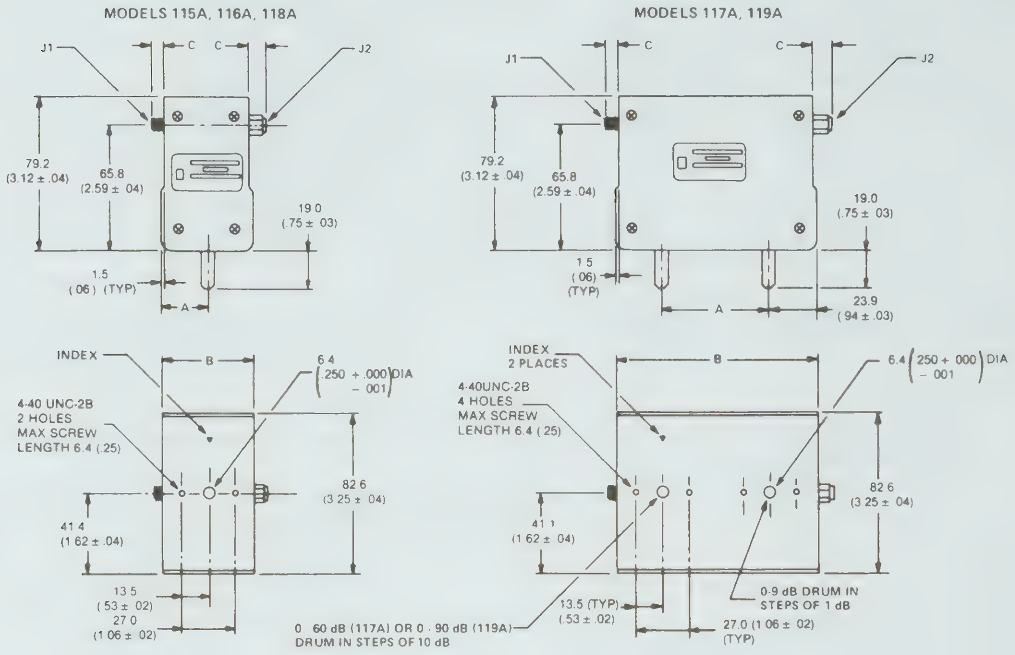
Example

AE119A - 99 - 32

Frequency Range
Basic Model Number
Maximum Attenuation Value (dB)
Connector Options
1st digit is J1 side
2nd digit is J2 side

Models 115A, 116A, 117A, 118A, & 119A
Manual Step Attenuators

PHYSICAL DIMENSIONS:


MODELS 115A, 116A, 118A
J1
C
C
J2
79.2 (3.12 ± .04)
65.8 (2.59 ± .04)
19.0 (.75 ± .03)
1.5 (.06) (TYP)
A
INDEX
B
6.4 (.250 + .000 − .001) DIA
4-40 UNC-2B 2 HOLES MAX SCREW LENGTH 6.4 (.25)
82.6 (3.25 ± .04)
41.4 (1.62 ± .04)
13.5 (.53 ± .02)
27.0 (1.06 ± .02)
MODELS 117A, 119A
J1
C
C
J2
79.2 (3.12 ± .04)
65.8 (2.59 ± .04)
19.0 (.75 ± .03)
1.5 (.06) (TYP)
23.9 (.94 ± .03)
A
INDEX 2 PLACES
B
6.4 (.250 + .000 − .001) DIA
4-40UNC-2B 4 HOLES MAX SCREW LENGTH 6.4 (.25)
82.6 (3.25 ± .04)
41.1 (1.62 ± .04)
0-9 dB DRUM IN STEPS OF 1 dB
13.5 (TYP) (.53 ± .02)
27.0 (1.06 ± .02) (TYP)
0 - 60 dB (117A) OR 0 - 90 dB (119A) DRUM IN STEPS OF 10 dB

Model No.	DiIM A	DIM B
119A	58.7 (2.31)	111.3 (4.38)
118A	54.0 (2.11)	101.1 (3.98)
117A	29.0 (1.14)	57.7 (2.27)
116A	23.9 (0.94)	47.5 (1.87)
115A	23.9 (0.94)	47.5 (1.87)

CONN. TYPE	DIM C
TNC, Male	35.0 (1.38)
TNC, Female	38.1 (1.50)
GPC-7	21.0 (0.83)
Type N, Male	20.6 (0.81)
Type N, Female	18.3 (0.72)
SMA, Male	9.4 (0.37)
SMA, Female	7.9 (0.31)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

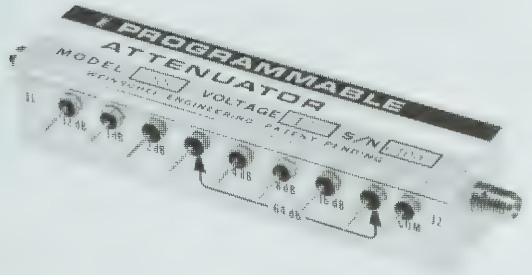
Lucas Aerospace
Communications & Electronics

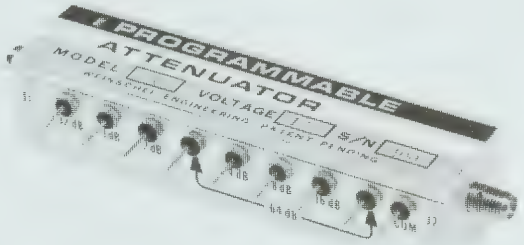
Models 3200 & 3201
PROGRAMMABLE ATTENUATORS FOR OEM

dc to 2 GHz

1 WATT

Ruggedized SMA Female Connectors


PROGRAMMABLE
ATTENUATOR
MODEL
VOLTAGE
S/N
WEINSCHEL ENGINEERING PATENT PENDING
J1
J2
4 dB
8 dB
16 dB
64 dB
COM


PROGRAMMABLE
ATTENUATOR
MODEL
VOLTAGE
S/N
WEINSCHEL ENGINEERING PATENT PENDING
J1
J2
4 dB
8 dB
16 dB
64 dB
COM

FEATURES

* **Wide Selection of Attenuation Ranges and Steps** -

127 dB/1 dB steps
63.75 dB/0.25 dB steps
31 dB/1 dB steps
120 dB/10 dB steps

* **Compact Sizes**

* **Excellent Repeatability**

* **Switching Time** - Cell switching is completed, after electrical command, within 6 msec.

* **Long Switch Life** - Each cell has a rated switch life in excess of 10,000,000 switching operations.

* **Special Configurations Available Upon Request.**

DESCRIPTION

The 3200 Series Programmable Step Attenuators are designed for use in automatic test equipment and OEM systems operating in the dc to 2 GHz frequency range. This Series is available in four standard attenuation ranges and cell configurations. Custom designed configurations are available upon request. Each cell contains a standard TO-5 type double-pole, double-throw relay that provides a minimum loss or attenuated path for the RF signal.

Microstrip circuitry and special compensation techniques produce flat attenuation versus frequency characteristics. The microstrip construction, using thick-film circuit elements, ensures product uniformity and minimizes special hand work usually required to achieve the performance specified. To minimize RF leakage, the 3200 Series Attenuators are provided with gold-plated contact areas and feedthrough filters at each control terminal.

Housed in rugged, light-weight compact cases, the 3200 Series meets many of the environmental requirements of MIL-A-24215, Class IV.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 2 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 1	1.25
1 - 2	1.35

POWER COEFFICIENT: < 0.005 dB/dB/watt

INCREMENTAL TEMPERATURE COEFFICIENT:

30 and 32 dB Cells:	0.00005 dB/dB/˚C
All other cells:	0.00002 dB/dB/˚C

SPECIFICATIONS (Con't)

CELL CONFIGURATIONS:

Model Number	NO. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3200-1	8	127/1	1, 2, 4, 8, 16, 32, and 64*
3200-2	8	63.75/0.25	1, 2, 4, 8, 16, 32, 0.5 and 0.25
3201-1	5	31/1	1, 2, 4, 8, and 16
3201-2	5	120/10	10, 20, 30, and 60**

* 64 dB cell comprised of two 32 dB cells

** 60 dB cell comprised of two 30 dB cells

INCREMENTAL ATTENUATION ACCURACY:

FREQUENCY RANGE (GHz)	ACCURACY
dc - 0.5	± 0.2 dB or 0.5 %
0.5 - 1	± 0.2 dB or 1 %
1 - 2	± 0.3 dB or 2 %

RATED SWITCH LIFE: 10,000,000 operations per cell

SWITCHING TIME: 6 msec. maximum at +12.0 V.

OPERATING VOLTAGE: + 12 V (+ 16 V maximum; + 9 V minimum)

OPERATING CURRENT: 14 mA typical per cell @ 12 V

TEMPERATURE RANGE (Operating):

-55 °C to +71 °C

MAXIMUM INSERTION LOSS:

Frequency Range (GHz)	3200-1 3200-2	3201-1 3201-2
dc - 0.5	3.00	2.25
0.5 - 1	3.50	2.75
1.0 - 1.5	4.25	3.25
1.5 - 2	4.75	3.75

* Insertion Loss Variation from -55 °C to 71 °C is less than 0.14 dB per cell.

MONOTONICITY: dc to 2.0 GHz

POWER RATING: 1 watt **average** to 25 °C ambient temperature, derated linearly to 0.25 watt @ 71 °C. 50 watts **peak** (5 µsec pulse width; 1% duty cycle)

CONTROL CONFIGURATION: One terminal is provided for a common return and is connected to case ground. The remaining terminals are provided for activation of individual cells. Attenuation is fail-safe to "0" setting in the absence of a control voltage. Applications of voltage (+) to a particular cell causes it to switch to the attenuate position.

Note: Control is non-latching and requires a continuous control signal for the period of time in which attenuation is required.

CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONTROL TERMINALS: 0.040 inch. (1 mm) diameter solderable leads. May be used with PC board sockets/receptacles.

CONSTRUCTION:

Housing:	Aluminum, gold plated
Connectors:	Stainless steel body and beryllium copper contacts.
Control terminals:	Brass/Copper, Silver plated

WEIGHT:	3200-1	126 g (4.4 oz)
	3200-2	126 g (4.4 oz)
	3201-1	94 g (3.3 oz)
	3201-2	94 g (3.3 oz)

U.S. Patents 3,157,846, 4,330,765

ACCESSORIES

Model 8200: Using this controller allows the user to control any Model 3200 via either front panel or IEEE-488 GPIB operation. Using a specially designed mounting Kit these attenuators can be easily installed into the controller (refer to Model 8200 data sheet).

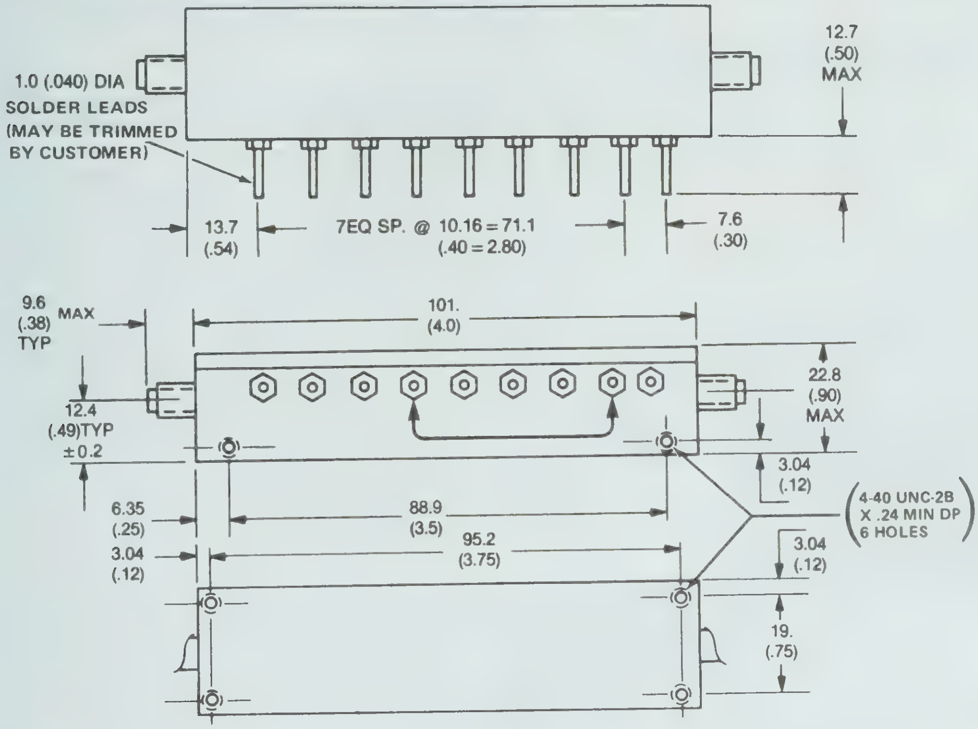
Model 3210: This controller allows the user to control a Model 3200-1 via either front panel thumb wheel or IEEE-488 GPIB operation (refer to Model 3210 data sheet).

TTL DRIVER BOARD OPTIONS: Models 3200-1, 3200-2, 3201-1 and 3201-2 are available with a TTL interface board mounted on the unit. The board is provided with a 15-pin miniature 'D' plug and requires + 15V; +5V; supply. A 3-foot length of cable is provided with a mating 15-pin socket on one end. Order as follows:

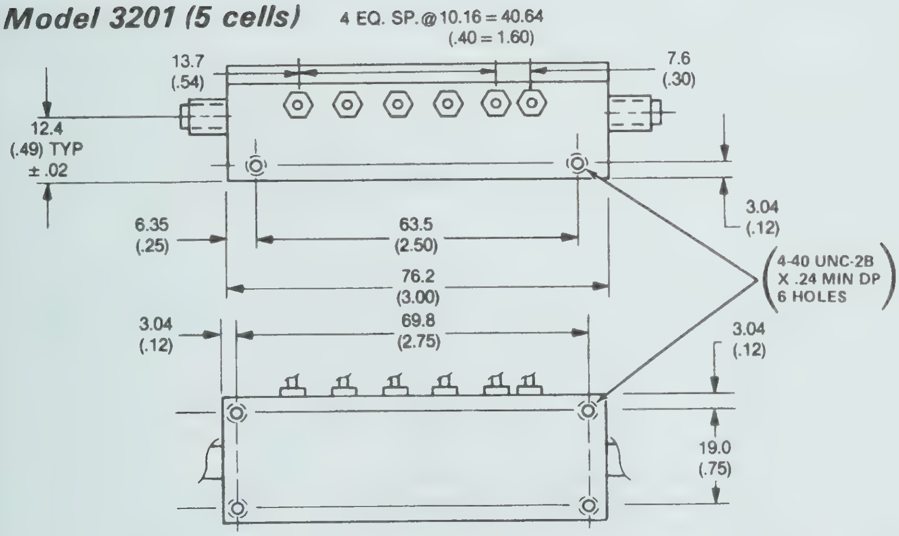
Standard Model	TTL Interface Board USE Model Number
3200-1	5272
3200-2	5312
3201-1	5314
3201-2	5315

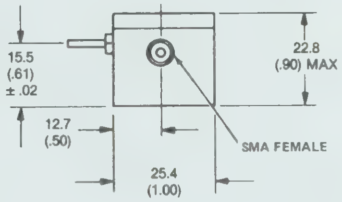
PHYSICAL DIMENSIONS:

Model 3200-1 (8 cells)


1.0 (.040) DIA
SOLDER LEADS
(MAY BE TRIMMED
BY CUSTOMER)
12.7
(.50)
MAX
13.7
(.54)
7EQ SP. @ 10.16 = 71.1
(.40 = 2.80)
7.6
(.30)
9.6
(.38)
TYP
MAX
101.
(4.0)
22.8
(.90)
MAX
12.4
(.49)TYP
±0.2
3.04
(.12)
6.35
(.25)
88.9
(3.5)
4-40 UNC-2B
X .24 MIN DP
6 HOLES
3.04
(.12)
95.2
(3.75)
3.04
(.12)
19.
(.75)

Model 3201 (5 cells)


4 EQ. SP.@10.16 = 40.64
(.40 = 1.60)
13.7
(.54)
7.6
(.30)
12.4
(.49) TYP
±.02
3.04
(.12)
6.35
(.25)
63.5
(2.50)
76.2
(3.00)
4-40 UNC-2B
X .24 MIN DP
6 HOLES
3.04
(.12)
69.8
(2.75)
3.04
(.12)
19.0
(.75)


15.5
(.61)
±.02
22.8
(.90) MAX
12.7
(.50)
SMA FEMALE
25.4
(1.00)

SIDE VIEW
ALL MODELS

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 3210
ATTENUATOR CONTROLLER

For use with Model 3200-1 Attenuator

FEATURES

- **Ideal for use in Automatic Test Equipment Setups -** The Model 3210 Attenuator Controller provides the necessary circuitry for local and remote control of the Model 3200-1 Programmable Step Attenuator (reter to Model 3200 data sheet for attenuator specifications).
- **Remote Operation** - GPIB Connector on the rear panel of the 3210 provides for an IEEE-488 interface. Through the interface, the value of the attenuator is determined by a remote controller.

DESCRIPTION

The Model 3210 Attenuator Controller provides local and remote control of Lucas Weinschel's 3200-1 programmable attenuator. The controller operates with the 3200-1 Attenuator plugged inside the unit.

Local control of attenuation setting is achieved through a thumbwheel switch, while a GPIB connector on the rear of the 3210 controller permits operation via the IEEE-488 Bus.

Sensitivity and linearity tests are done easily under bus control. Programming the level of a signal source is also facilitated with the 3210 Attenuator Controller.

With the 3200-1 attenuator, the 3210 provides an attenuation range of 0 to 127 dB steps over a frequency range of dc to 2 GHz.

SPECIFICATIONS

REMOTE CONTROL: Configured for IEEE-488 (GPIB) Bus operation.

TEMPERATURE RANGE (Operating): 0 °C to +50 °C

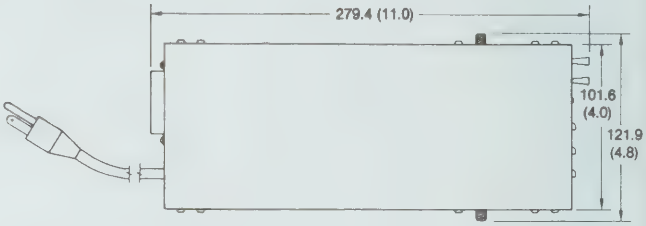
CONNECTORS 3210: GPIB 24 Multipin connector

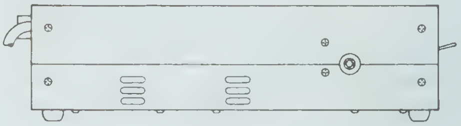
CONNECTORS 3200-1: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

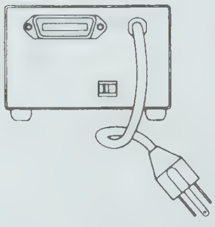
POWER REQUIREMENTS: 115/230 volts, 48 to 62 Hz

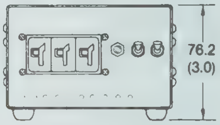
WEIGHT: Net 1,520 g (3.35 lbs.)

PHYSICAL DIMENSIONS:









NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

ORDERING INFORMATION

Model 3210:	Controller without Model 3200-1 Programmable Attenuator
Model 3210-01:	Controller including Model 3200-1 Programmable Attenuator.

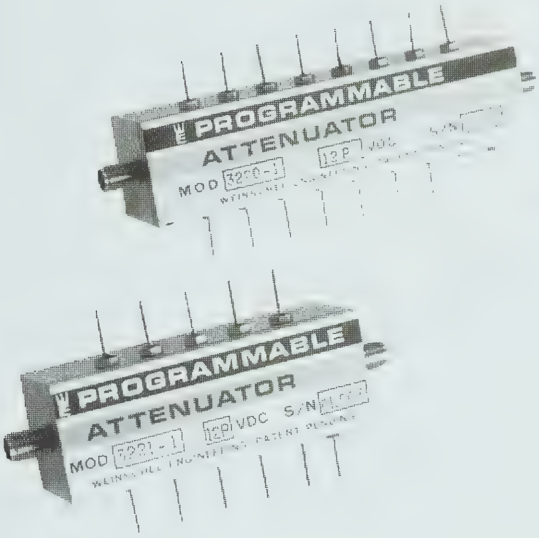
Model 3220 & 3221

LATCHING PROGRAMMABLE STEP ATTENUATORS FOR OEM

dc to 2.0 GHz

1 WATT

Ruggedized SMA Connectors



FEATURES

- **Three Standard Attenuation Ranges -**
  - 0 to 127 dB/1 dB steps
  - 0 to 31 dB/1 dB steps
  - 0 to 120 dB/10 dB steps
- **Compact Sizes**
- **Excellent Repeatability**
- **Switching Time** - 1.5 msec maximum at rated coil voltage
- **Long Switch Life** - Each cell has a rated switch life of 10,000,000 operations
- **Power Consumption** - No continuous dc power drain. Ideal for battery operated or portable equipment
- **Special Configurations available upon request**.

DESCRIPTION

The Model 3220 and 3221 Latching Programmable Step Attenuators are designed for use in ATE and OEM systems operating in the dc to 2.0 GHz frequency range.

Each cell employs a DPDT magnetic latching RF relay that provides the switching action between "characteristic zero" and "attenuation" states.

Use of thick film microstrip circuitry on a ceramic substrate ensures a virtually flat frequency response and product uniformity. Excellent RF ground is maintained through use of goldplated contact areas. This ensures minimum RF leakage and guaranteed monotonicity/linearity over the full attenuation and frequency range.

Since the control configuration is latching, there is no continuous dc power drain through the relay coils. Consequently, the units run cooler, resulting in improved stability and contact repeatability when compared to non-latching types. For a typical 8-cell unit, the power dissipation is 2 to 3 watts less than its non-latching version. This feature also makes latching attenuators ideal for battery operated equipment.

Housed in rugged, light-weight cases, the 3220 series are designed to meet many of the environmental requirements of MIL-A-24215 Class V including shock and vibration.

Models 3220 & 3221

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 2 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 1	1.25
1 - 2	1.35

POWER COEFFICIENT: < 0.002 dB/dB/watt

INCREMENTAL TEMPERATURE COEFFICIENT:

30 and 32 dB Cells:	0.00005 dB/dB/ ˚C
All other cells:	0.00002 dB/dB/ ˚C

CELL CONFIGURATIONS:

Model Number	NO. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3220-1	8	127/1	1, 2, 4, 8, 16, 32, and 64*
3221-1	5	31/1	1, 2, 4, 8, and 16
3221-2	5	120/10	10, 20, 30, and 60**

* 64 dB cell comprised of two 32 dB cells

** 60 dB cell comprised of two 30 dB cells

INCREMENTAL ATTENUATION ACCURACY:

FREQUENCY RANGE (GHz)	ACCURACY
dc - 0.5	± 0.2 dB or 0.5 %
0.5 - 1	± 0.2 dB or 1 %
1 - 2	± 0.3 dB or 2 %

RATED SWITCH LIFE: 10,000,000 operations per cell

SWITCHING TIME: 1.5 msec maximum at rated switch voltage.

OPERATING VOLTAGE: + 12 V pulse (+ 16 V maximum; + 9 V minimum) 3.5 msec pulse width

OPERATING CURRENT: 24 mA typical per cell @ 12 V

TEMPERATURE RANGE (Operating): -55 to +71 ˚C

CHARACTERISTIC ZERO LOSS (MAXIMUM): *

Frequency Range (GHz)	3220-1	3221-1 3221-2
dc - 0.5	2.50	1.75
0.5 - 1	3.25	2.50
1.0 - 1.5	3.75	2.75
1.5 - 2	4.25	3.25

* Insertion Loss variation from -55 ˚C to 71 ˚C is less than 0.14 dB per cell.

MONOTONICITY: dc to 2.0 GHz

POWER RATING: 1 watts **average** to 25 ˚C ambient temperature, derated linearly to 0.25 watt @ 71 ˚C.
50 watts **peak** (5 µsec pulse width; 1 % duty cycle).

CONTROL CONFIGURATION: One terminal is provided for a common return and is connected to case and switch ground. Each cell is provided with two terminals (RF decoupled), one to energize the cell to a predetermined attenuation setting and the other to re-set the cell to its characteristic zero attenuation state. The switch configuration is latching and does not require a continuous control signal to maintain either state.

CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONTROL TERMINALS: 0.040 inch. (1 mm) diameter solderable leads. May be used with PC board sockets/receptacles.

CONSTRUCTION:

Housing:	Aluminum, gold plated
Connectors:	Stainless steel body and beryllium copper contacts.
Control terminals:	Brass/Copper, Silver plated

WEIGHT:

3220-1:	126 g (4.4 oz.)
3221-1:	94 g (3.3 oz.)
3221-2:	94 g (3.3 oz.)

U.S. Patents 3,157,846, 4,330,765

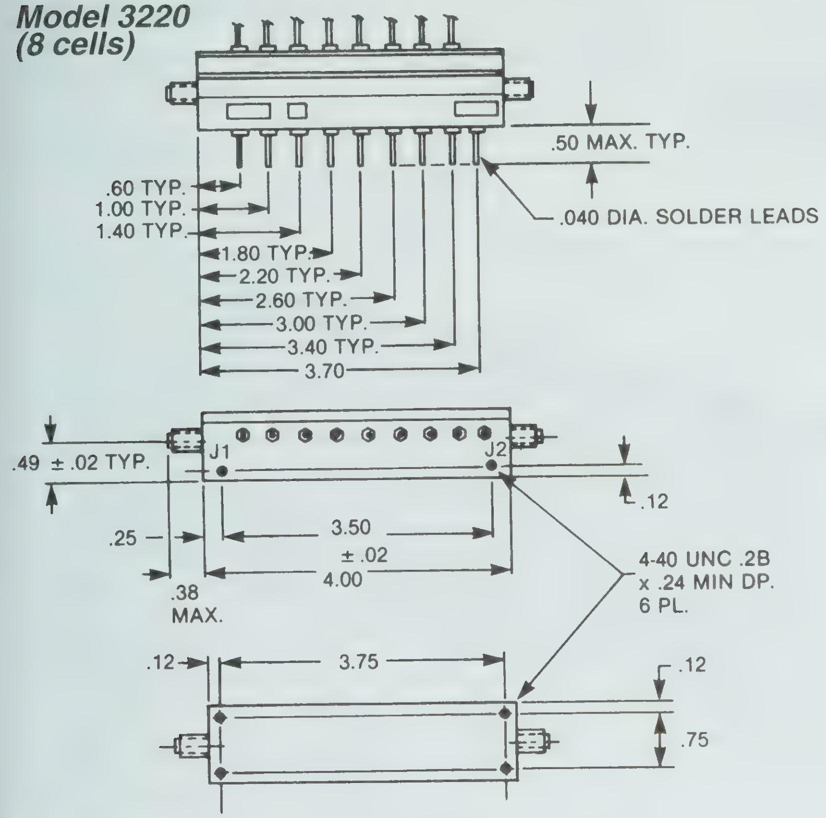
ACCESSORIES

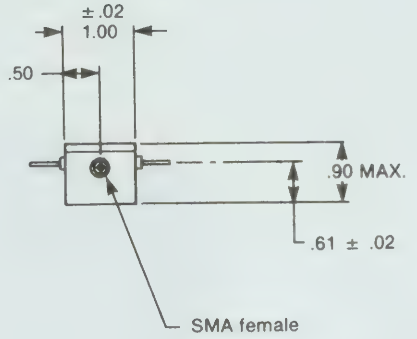
Model 8200 Controller: Using this controller allows the user to control any Model 3220 and/or 3221 via either front panel or IEEE-488 GPIB operation. Using a specially designed mounting Kit these attenuators can be easily installed into the controller (refer to Model 8200 data sheet).

Latching Programmable Step Attenuators

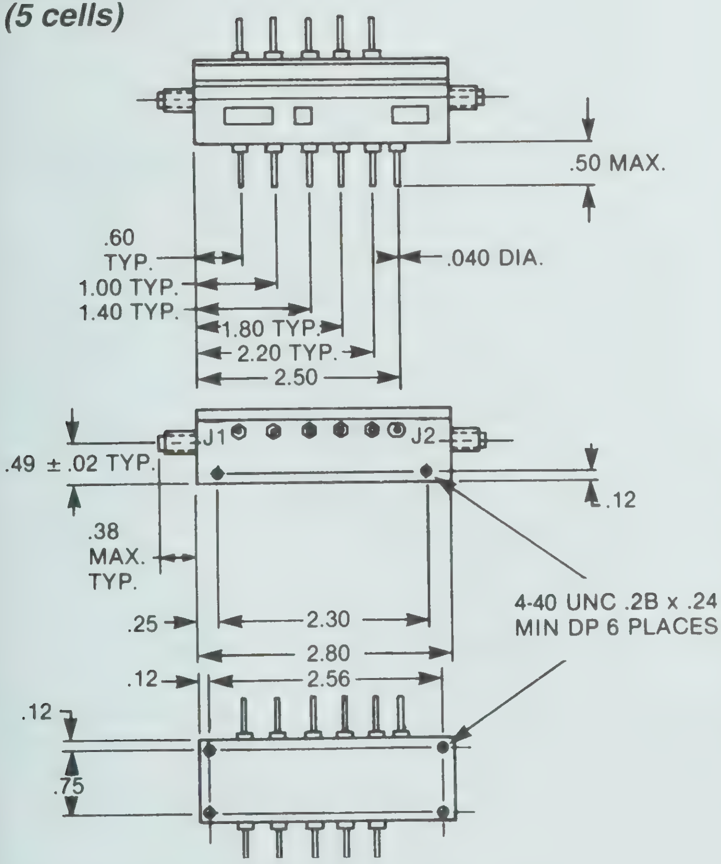
PHYSICAL DIMENSIONS:

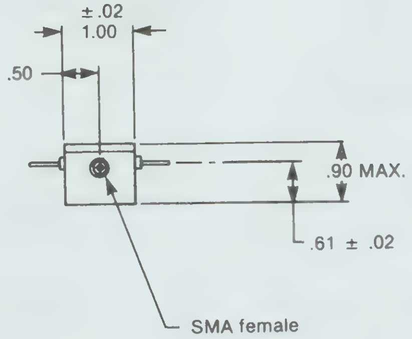
Model 3220 (8 cells)


.50 MAX. TYP.
.60 TYP.
1.00 TYP.
1.40 TYP.
.040 DIA. SOLDER LEADS
1.80 TYP.
2.20 TYP.
2.60 TYP.
3.00 TYP.
3.40 TYP.
3.70
.49 ± .02 TYP.
J1
J2
.12
.25
3.50
± .02
4.00
.38
MAX.
4-40 UNC .2B
x .24 MIN DP.
6 PL.
.12
3.75
.12
.75


± .02
1.00
.50
.90 MAX.
.61 ± .02
SMA female

Model 3221 (5 cells)


.50 MAX.
.60
TYP.
1.00 TYP.
1.40 TYP.
.040 DIA.
1.80 TYP.
2.20 TYP.
2.50
.49 ± .02 TYP.
J1
J2
.12
.38
MAX.
TYP.
.25
2.30
2.80
4-40 UNC .2B x .24
MIN DP 6 PLACES
.12
2.56
.12
.75


± .02
1.00
.50
.90 MAX.
.61 ± .02
SMA female

NOTE: All dimensions are given in inches and are maximum, unless otherwise specified. mm equivalents are listed below.

mm	in	mm	in	mm	in
0.508	0.03	15.494	0.61	63.5	2.50
1.016	0.040	19.05	0.75	65.024	2.56
3.048	0.12	22.86	0.90	66.04	2.60
6.35	0.38	25.4	1.00	71.12	2.80
9.652	0.38	35.56	1.40	76.2	3.00
12.446	0.49	45.72	1.80	86.36	3.40
12.7	0.50	55.88	2.20	88.9	3.50

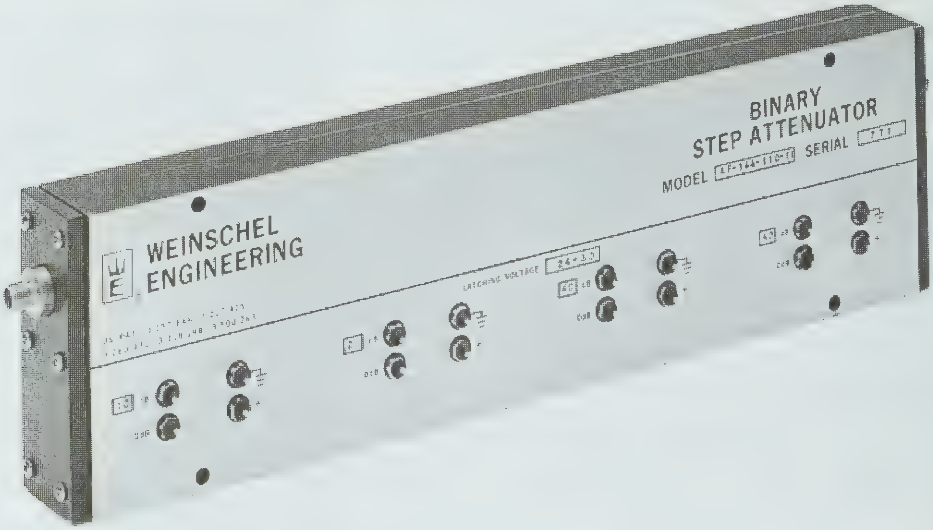
Model 144

RAPID SWITCHING BINARY STEP ATTENUATOR

dc to 18.0 GHz

2 WATTS

Ruggedized SMA Connectors


WEINSCHEL ENGINEERING
BINARY STEP ATTENUATOR
MODEL
SERIAL
LATCHING VOLTAGE

FEATURES

- **Long Life and High-Speed Switching**
- **Latched Operation** - Selected attenuation positions are positively latched after switching even with loss of drive power.
- **Self-Disconnecting** - Internal switches interrupt coil current after switching is complete even if power is continuously applied.
- **Rugged** - Designed to meet most environmental requirements of MIL-STD-810C (Vibration, Shock, Atmosphere and Acoustical Noise).

DESCRIPTION

These attenuators provide programmable adjustments of RF signal levels in precise steps of 1 dB to 11 dB, 1 dB to 15 dB, 2 dB to 30 dB, 3 dB to 45 dB and 10 dB to 110 dB. Each attenuator consists of a cascaded assembly of switched attenuator cells (Figure 1). The attenuator elements located in the attenuator cell are created using a thin-film process which ensures exceptional long-term stability, low power and temperature coefficients. This series of Programmable Step Attenuators uses a switching structure that provides rapid switching together with low insertion loss.

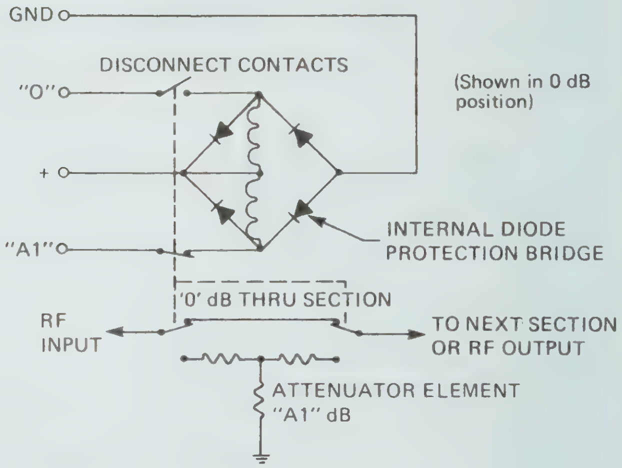

GND
DISCONNECT CONTACTS
"O"
(Shown in 0 dB position)
+
"A1"
INTERNAL DIODE PROTECTION BRIDGE
'0' dB THRU SECTION
RF INPUT
TO NEXT SECTION OR RF OUTPUT
ATTENUATOR ELEMENT "A1" dB

Figure 1. Typical Attenuator Cell Schematic

Model 144 Rapid Switching Binary Step Attenuators

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGES (add Model No. Prefix to Designate Range):

All Models:	dc to 4.0 GHz (AC)
	dc to 8.0 GHz (AD)
	dc to 12.4 GHz (AE)
	dc to 18.0 GHz (AF)

STANDARD INCREMENTAL ATTENUATION RANGE:

Model 144-11:	0 to 11 dB in 1 dB steps
Model 144-15:	0 to 15 dB in 1 dB steps
Model 144-30:	0 to 30 dB in 2 dB steps
Model 144-45:	0 to 45 dB in 3 dB steps
Model 144-110:	0 to 110 dB in 10 dB steps

POWER RATING: 2 watts **average** to 25 °C ambient temperature, derated linearly to 1 watt @ 54 °C.
500 watts **peak** (5 msec pulse width; 1 % duty cycle)

POWER COEFFICIENT: < 0.001 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.001 dB/dB/ °C

INCREMENTAL INSERTION LOSS (±dB):

Model Number	dB Range	Frequency Range (GHz)			
		dc-4	dc-8	dc-12.4	dc-18
144-11	1	0.2	0.3	0.3	0.5
	2	0.2	0.3	0.3	0.5
	3	0.3	0.4	0.4	0.5
	4	0.3	0.4	0.4	0.6
	5	0.3	0.4	0.4	0.6
	6	0.4	0.4	0.4	0.6
	7	0.4	0.6	0.6	0.9
	8	0.4	0.6	0.6	0.9
	9	0.4	0.6	0.6	0.9
	10	0.4	0.6	0.6	0.9
	11	0.5	0.8	0.8	1.2
144-15	1	0.2	0.3	0.3	0.5
	2	0.2	0.3	0.3	0.5
	3	0.3	0.4	0.4	0.6
	4	0.3	0.4	0.4	0.6
	5	0.3	0.4	0.4	0.6
	6	0.4	0.4	0.4	0.6
	7	0.4	0.6	0.6	0.9
	8	0.4	0.6	0.6	0.9
	9	0.4	0.6	0.6	0.9
	10	0.4	0.6	0.6	0.9
	11	0.5	0.8	0.8	1.2
	12	0.6	0.8	0.8	1.2
	13	0.8	1.0	1.0	1.4
	14	0.8	1.0	1.0	1.4
	15	1.0	1.2	1.2	1.6
144-30	2	0.2	0.3	0.3	0.5
	4	0.3	0.4	0.4	0.6
	6	0.4	0.4	0.4	0.6
	8	0.4	0.6	0.6	0.9
	10	0.4	0.6	0.6	0.9
	12	0.6	0.8	0.8	1.2
	14	0.8	1.0	1.0	1.4
	16	1.0	1.2	1.2	1.6
	18	1.0	1.2	1.2	1.6
	20	1.0	1.2	1.2	1.6
	22	1.3	1.5	1.5	1.8
	24	1.3	1.5	1.5	1.8
	26	1.3	1.5	1.5	1.8
	28	1.3	1.5	1.5	1.8
	30	1.3	1.5	1.5	1.8
144-45	3	0.4	0.4	0.4	0.5
	6	0.4	0.4	0.4	0.7
	9	0.5	0.5	0.5	0.7
	12	0.6	0.6	0.6	0.8
	15	0.6	0.7	0.7	0.8
	18	0.6	0.7	0.7	0.8
	21	0.6	0.7	0.7	0.8
	24	0.8	0.8	0.8	1.0
	27	0.8	1.0	1.0	1.2
	30	0.8	1.0	1.0	1.2
	33	0.9	1.1	1.1	1.3
	36	0.9	1.1	1.1	1.4
	39	1.0	1.2	1.2	1.5
	42	1.2	1.2	1.2	1.8
	45	1.3	1.5	1.5	1.8
144-110	10	0.4	0.5	0.5	0.6
	20	0.6	0.7	0.7	0.8
	30	0.8	1.0	1.0	1.2
	40	1.0	1.2	1.2	1.5
	50	1.3	1.5	1.5	1.8
	60	1.5	1.8	1.8	2.2
	70	1.8	2.0	2.0	2.6
	80	2.0	2.3	2.3	2.9
	90	2.3	2.5	2.5	3.3
	100	2.6	2.8	2.8	3.6
	110	2.7	3.0	3.0	4.0

INCREMENTAL INSERTION LOSS (Con't):

SWITCHING VOLTAGE: 27 ± 3 V (3.1 Watts @ 50 millisecond duration required to switch one cell)

SWITCHING SPEED: 35 milliseconds or less

OPERATIONAL LIFE (Per Cell): 2,000,000 switchings (switching from "0" position to "A" position is one switching.)

SPECIFICATIONS (Con't)

MAXIMUM INSERTION LOSS AND SWR:

Frequency Range (GHz)	Insertion Loss (dB)	SWR
dc - 4	1.0	1.40
4 - 8	1.2	1.50
8 - 12.4	1.8	1.60
12.4 - 18	2.4	1.90

REPEATABILITY (after 2,000,000 operations - 4 cells):

dc to 12.4 GHz:	Typically 0.02 dB
12.4 to 18 GHz:	Typically 0.04 dB

ELECTROMAGNETIC COMPATIBILITY: Per MIL-STD-461, 462, 463.

TEMPERATURE RANGE:

Operating:	-20 ˚C to + 85 ˚C
Nonoperating:	-62 ˚C to +85 ˚C

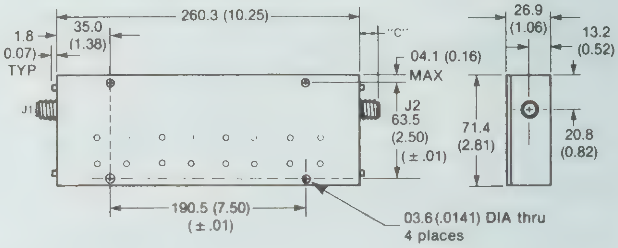
CONSTRUCTION: Aluminum housing painted armor hide.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Option	Type/Description
1	SMA, Female
2	SMA, Male

WEIGHT: Net: 1,140 g (40 oz.)

PHYSICAL DIMENSIONS:



CONN. TYPE	DIM A
SMA, Female SMA, Male	10.7 (0.40) 13.2 (0.52)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

MODEL NUMBER DESCRIPTION:

Example

AE144 - 110 - 11

Frequency Range	Basic Model Number	Maximum Attenuation Value (dB)	Connector Options 1st digit is J1 side 2nd digit is J2 side

Lucas Aerospace
Communications & Electronics

Model 150
Model 151
Model 152
PROGRAMMABLE STEP ATTENUATORS

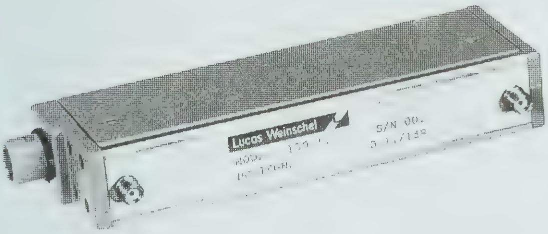
dc to 18.0 GHz

dc to 4.0 GHz

dc to 26.5 GHz

1 WATT

For OEM & System Use



Lucas Weinschel

The Models 150, 151, and 152 Programmable Step Attenuators represent the widest variety of programmable attenuators available. This attenuator design is the result of an extensive development program. This design offers long reliable operation with exceptional accuracy and repeatability. These attenuators can provide programmable adjustments of RF signal levels in precise steps of 1 dB, 5 dB, 10 dB, or with custom steps available. Each attenuator consists of a cascaded assembly of switched attenuator cells (Figure 1). The attenuator elements located in the attenuator cell are created by a proprietary thin-film process which provides exceptional long-term stability, low power and temperature coefficients. This series of Programmable Step Attenuators uses a reed switching structure that provides rapid switching together with low insertion loss. Other features of these Programmable Step Attenuators include:

- 3 or 4 Cell Configurations
- Broadband Frequency Coverage
- High Accuracy and Repeatability
- Long Life, 5 Million Cycles Per Cell

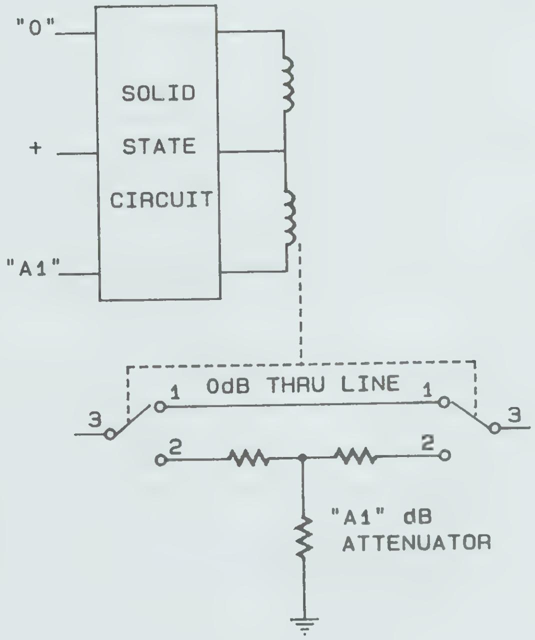


Figure 1. Typical Attenuator Cell Schematic

CELL CONFIGURATIONS

The following Table provides the standard attenuation ranges, increments, and cell configurations for all Lucas Weinschel Inc Programmable Step Attenuators (Models 150, 151, and 152).

		CELL 1		CELL 2		CELL 3		CELL 4	
ATTN Range	Comments	Bypass	Attenuator Element	Bypass	Attenuator Element	Bypass	Attenuator Element	Bypass	Attenuator Element
11 dB		0 dB	1 dB	0 dB	4 dB	0 dB	2 dB	0 dB	4 dB
15 dB		0 dB	1 dB	0 dB	8 dB	0 dB	2 dB	0 dB	4 dB
55 dB		0 dB	5 dB	0 dB	10 dB	0 dB	20 dB	0 dB	20 dB
70 dB	4 CELL	0 dB	10 dB	0 dB	20 dB	0 dB	20 dB	0 dB	20 dB
	3 CELL	0 dB	10 dB	0 dB	40 dB	0 dB	20 dB	---	---
75 dB		0 dB	5 dB	0 dB	40 dB	0 dB	20 dB	0 dB	10 dB
90 dB		0 dB	10 dB	0 dB	30 dB	0 dB	20 dB	0 dB	30 dB
110 dB		0 dB	10 dB	0 dB	40 dB	0 dB	20 dB	0 dB	40 dB
Conn PIN #	Round	5	6	9	10	7	8	11	12
	Ribbon	13	2	3	9	11	5	4	10
Wire Color	Round	Purple	Yellow	Orange	Blue	Black	Green	Brown	White
	Ribbon	Orange	Yellow	Blue	Brown	Purple	Black	Gray	White

Control Voltage (+ 24 or +5) = pin 1/red (round) or pin 6/red (ribbon)

PROGRAMMABILITY: In each Programmable Step Attenuator, solenoids are used to switch the internal resistor card of each cell into and out of the circuit. The switching is activated by the application of a negative control voltage to the desired pin located in the control connector. Once the cell is switched, the solenoid is magnetically latched into position and is able to withstand extreme shock and vibration. Internal circuitry is included to interrupt the coil current after switching is complete. This reduces power dissipation even if power is continuously applied. The switching time for each cell is rated at 20 msec maximum which includes the contact settling time.

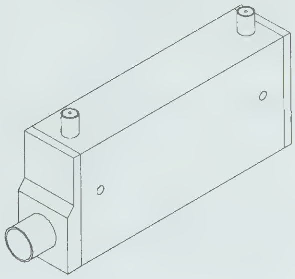
BROADBAND ACCURACY & LOW SWR: The use of Lucas Weinschel's proprietary thin-film resistor process provides these Programmable Step Attenuators with a high degree of accuracy and the lowest possible SWR uncertainty (refer to specifications for actual values). This thin film process permits the construction of circuits which are truly distributed and without stray reactances, even at the higher microwave frequencies.

RELIABILITY: Each Programmable Step Attenuator is composed of 3 or 4 (in most models) cells. As with all mechanical designs, usable life becomes a primary concern to the user. With this in mind Lucas Weinschel backs all of its Programmable Step Attenuators with a rated switch life of 5 million operations per cell. Standardized testing is also performed on each Programmable Step Attenuator over its operating frequency range by a computer controlled Lucas Weinschel Attenuation Measurement System which is traceable to NIST standards.

ENVIRONMENTAL: These Model 150 Programmable Step Attenuators have undergone an extensive environmental qualification program and have been subjected to temperature, shock, vibration, and humidity conditions per MIL-STD-202F. These Programmable Step Attenuators operate within these specifications at an ambient temperature of -20° to +75° C. Operating beyond these limits will adversely affect the accuracy and could damage the internal circuitry.

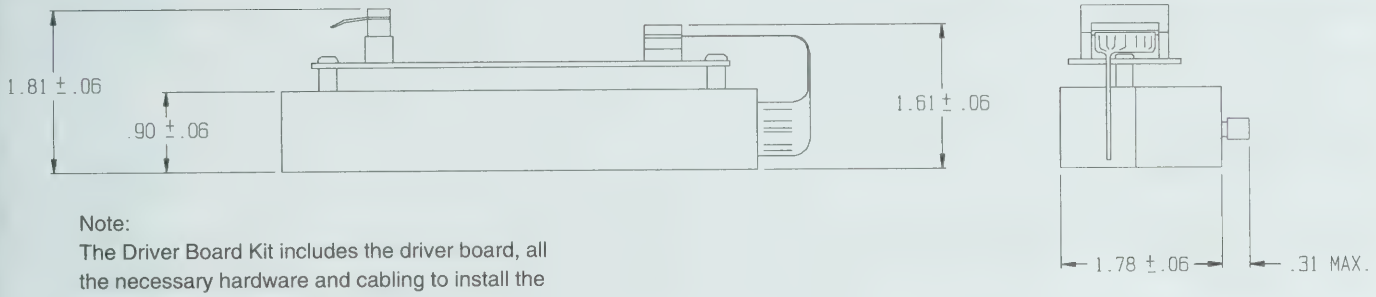
U. S. Patent 4,431,255

INSTALLATION



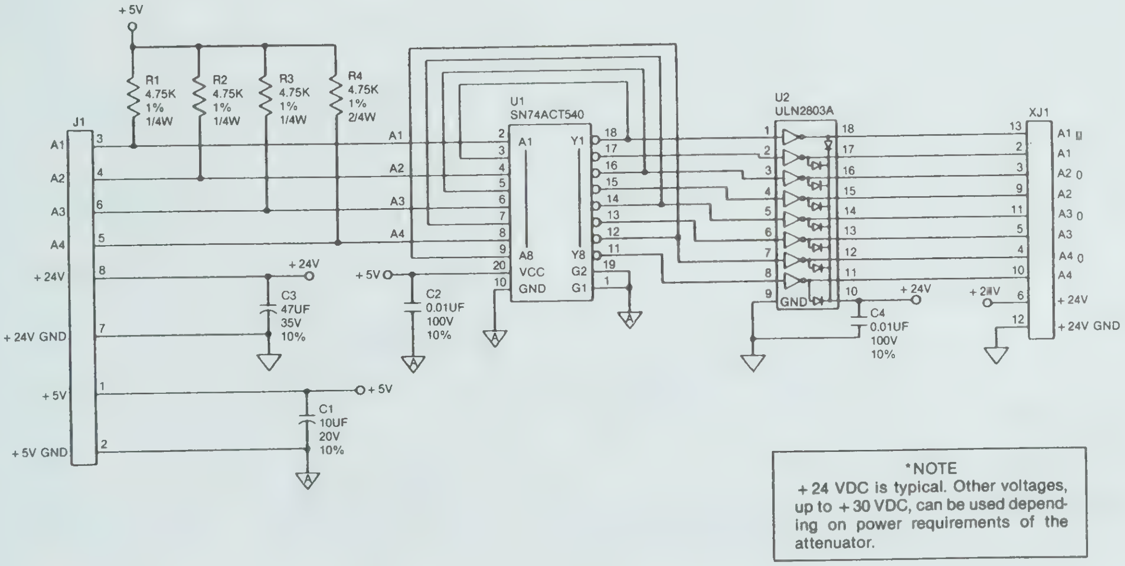
MOUNTING: These Programmable Step Attenuators can be easily installed into various types of mircowave signal generators, sweepers, ATE systems, or any other automated application where level control is needed. Each attenuator is supplied with two mounting holes on each side (4-40 UNC-2B x 0.22 MIN DP). This allows the attenuator to be easily mounted into an assembly or larger system.

DRIVER CIRCUIT: Lucas Weinschel has designed a custom driver board that will control any of its Models 150, 151, or 152 Programmable Step Attenuators. This Driver Board can be mounted to either side of a 3 or 4 Cell Attenuator (Figure 2). The driver board provides a TTL/CMOS interface and requires +5 V to operate the logic circuits and the appropriate attenuator operating voltage of the attenuator). Order Driver Board Kit using P/N 149-166-1 for 4 cell models and P/N 149-166-2 for 3 cell models.


1.81 ± .06
.90 ± .06
1.61 ± .06
1.78 ± .06
.31 MAX.

Note:
The Driver Board Kit includes the driver board, all the necessary hardware and cabling to install the driver to the attenuator.

Figure 2. Typicial Driver Board Installation


+5V
R1 4.75K 1% 1/4W
R2 4.75K 1% 1/4W
R3 4.75K 1% 1/4W
R4 4.75K 1% 2/4W
J1
A1
A2
A3
A4
+24V
+24V GND
+5V
+5V GND
C3 47UF 35V 10%
C2 0.01UF 100V 10%
C1 10UF 20V 10%
U1 SN74ACT540
VCC
GND
G1
G2
U2 ULN2803A
C4 0.01UF 100V 10%
XJ1
+24V GND

*NOTE
+24 VDC is typical. Other voltages, up to +30 VDC, can be used depending on power requirements of the attenuator.

Figure 3. Typical Driver Schematic for +24 V Models ONLY.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGES:

Model 151:	dc to 4 GHz
Model 150:	dc to 18 GHz
Model 152:	dc to 26.5 GHz

OPERATIONAL VOLTAGE: + 24 V Nominal (+20 V minimum to +30 V maximum) or +5 V Nominal (+4 V minimum* to +7 V maximum)

* Minimum operating voltage derated to +4.25 V @ 55 °C and further derated to +4.5 V @ 75 °C

POWER RATING: 1 watt average, 100 watts peak

TEMPERATURE: -20° to +75 °C operating
-55° to +85 °C nonoperating

TEMPERATURE COEFFICIENT: < 0.0001 dB/dB/° C

POWER SENSITIVITY: < 0.001 dB/dB/ Watt

RATED SWITCH LIFE: 5 million cycles per cell

RF INPUT CONNECTORS: Rugged female SMA which mate nondestructively with SMA male connectors per MIL-STD-39012.

CONTROL CONNECTOR: 12 pin Viking TKP12-101 connector with 5' cable or 14 conductor 16" ribbon cable with connector

VOLTAGE/CONNECTOR OPTIONS:

VOLTAGE	MODEL(S)
+ 24 V with Viking Connector	150-XX, 151-XX, 152-XX
+ 24 V with Ribbon Cable	150-XX-1, 151-XX-1, 152-XX-1
+ 5 V with Viking Connector	150-XX-2, 151-XX-2, 152-XX-2
+ 5 V with Ribbon Cable	150-XX-3, 151-XX-3, 152-XX-3

SWITCHING SPEED: 20 msec (includes settling time)

CONTROL PULSE WIDTH: 20 msec (minimum)

SWITCHING CURRENT: ≈ 125 mA @ +24 V per cell
≈ 300 mA @ +5 V per cell

REPEATABILITY: ± 0.01 typical to 18 GHz
± 0.05 dB typical to 26.5 GHz

VIBRATION: MIL-STD-202F, Method 204D Cond B

ALTITUDE: MIL-STD-202F, Method 105C Cond B, 50,000 Ft.

SHOCK: MIL-STD -202F, Method 213B Cond B, except 10G, 6 msec

HUMIDITY: MIL-STD-202C, Method 103B, Cond. B (96 Hrs. @ 95%, RH)

EMC: Radiated interference is within the requirements of MIL-STD-461 method RE02, VDE 0871 and CISPR Publication II.

MAXIMUM SWR (50 Ω Characteristic Impedance):

APPLICABLE MODELS	FREQUENCY (GHz) dc-4	 4-18	 18-26.5
151-11, 151-15, 151-75, 151-110	1.5	- - -	- - -
150-11, 150-15, 150-75, 150-110	1.5	1.9	- - -
151-70 (3 cell)	1.35	- - -	- - -
150-70 (3 cell)	1.35	1.7	- - -
152-55, 152-70, 152-90	1.4	1.6	1.8

MAXIMUM INSERTION LOSS (± dB):

APPLICABLE MODELS	FREQUENCY (GHz) dc-4	 4-18	 18-26.5
151-11, 151-15, 151-75, 151-110	0.9	- - -	- - -
150-11, 150-15, 150-75, 150-110	0.9	2.2	- - -
151-70 (3 cell)	0.7	- - -	- - -
150-70 (3 cell)	0.7	1.6	- - -
152-55, 152-70, 152-90	0.9	2.0	2.98

INCREMENTAL ATTENUATION ACCURACY (± dB):

dc-4 GHz (Model 151):

Total	dB SETTING														
ATTN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	- -	- -	- -	- -
15	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	05	0.5	0.5	0.5	0.5.

Total	dB SETTING																		
ATTN	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	90	100	110
70	- -	0.2	- -	0.3	- -	0.5	- -	0.7	- -	0.9	- -	0.9	- -	1.1	- -	- -	- -	- -	- -
75	0.2	0.2	0.4	0.3	0.5	05	0.7	0.7	0.9	0.9	1.1	1.1	1.2	1.2	1.4	- -	- -	- -	- -
110	- -	0.2	- -	0.3	- -	0.5	- -	0.7	- -	0.9	- -	1.0	- -	1.2	- -	1.4	1.6	1.7	1.9

dc-18 GHz (Model 150):

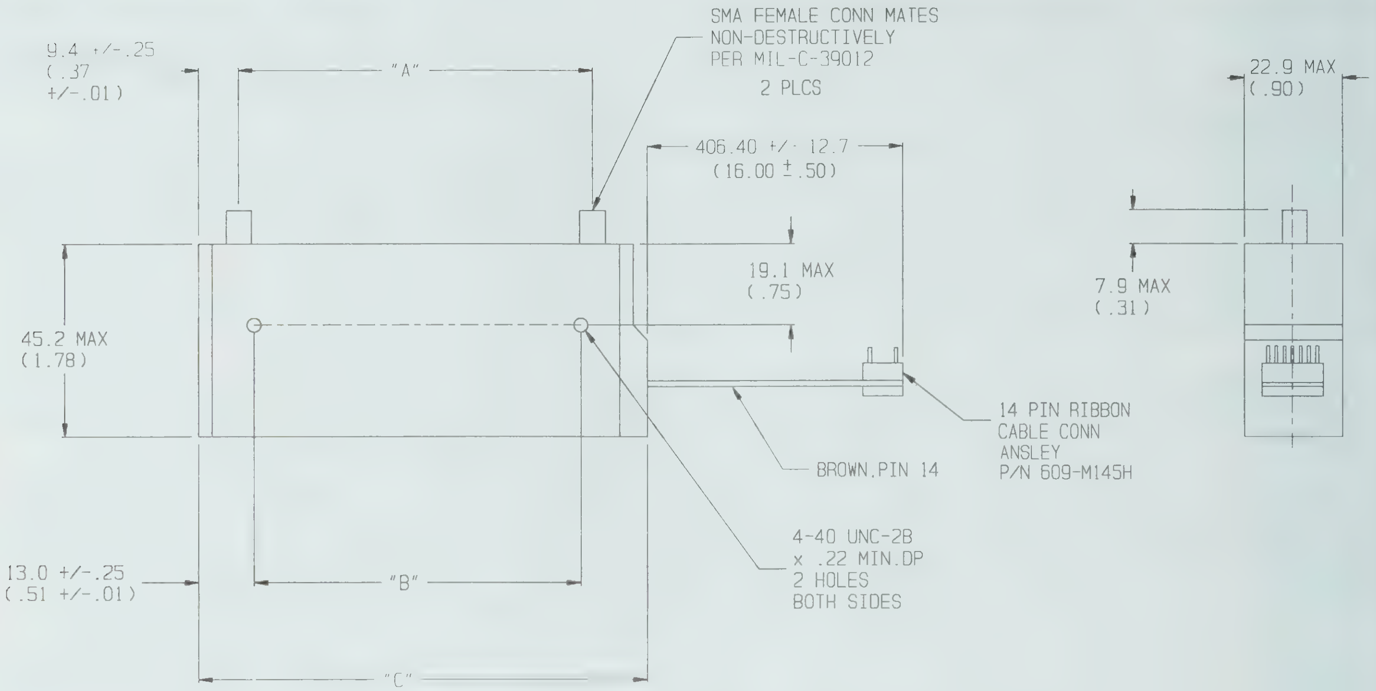
Total	dB SETTING														
ATTN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	- -	- -	- -	- -
15	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8

Total	dB SETTING																		
ATTN	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	90	100	110
70	- -	0.4	- -	0.8	- -	1.2	- -	1.6	- -	2.0	- -	2.4	- -	2.4	- -	- -	- -	- -	- -
75	0.4	0.4	0.8	0.8	1.2	1.2	1.6	1.6	2.0	2.0	2.4	2.4	2.8	2.8	2.8	- -	- -	- -	- -
110	- -	0.4	- -	0.8	- -	1.2	- -	1.6	- -	2.0	- -	2.4	- -	2.8	- -	3.2	3.6	4.0	4.0

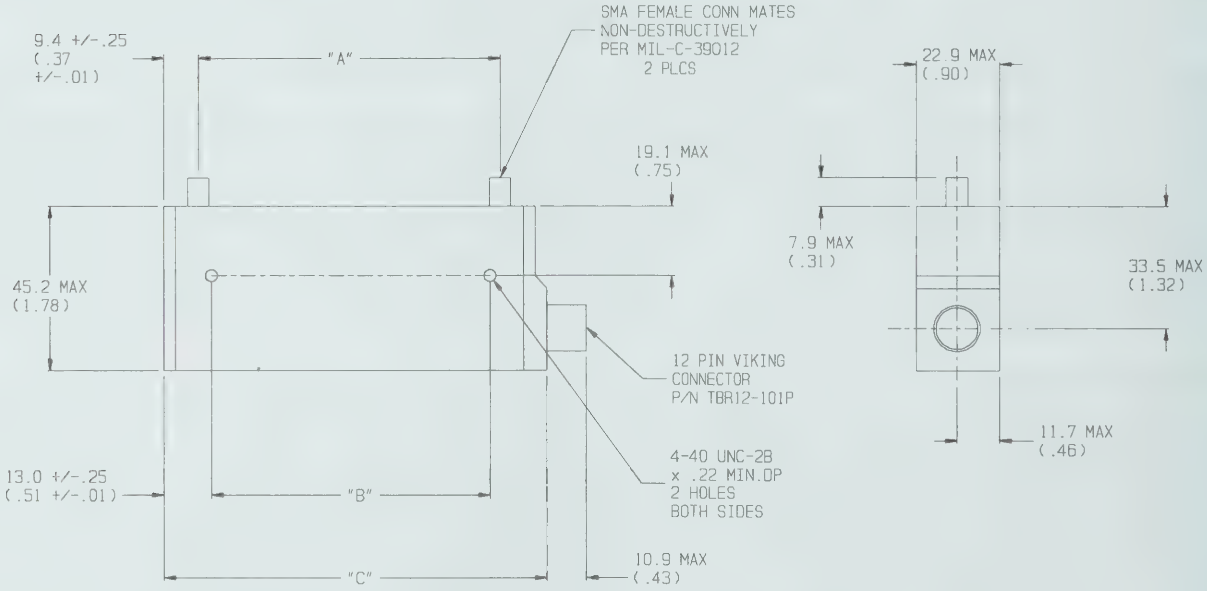
dc-26.5 GHz (Model 152):

Total	dB SETTING														
ATTN	5	10	15	20	25	30	35	40	45	50	55	60	70	80	90
55	0.5	0.5	0.6	0.6	0.6	0.9	1.2	1.4	1.4	1.5	2.0	-	- -	- -	- -
70	- -	0.5	- -	0.6	- -	0.9	- -	1.4	- -	1.5	- -	1.8	2.3	- -	- -
90	- -	0.5	- -	0.6	- -	0.9	- -	1.4	- -	1.5	- -	1.8	2.3	2.4	2.9

PHYSICAL DIMENSIONS


9.4 +/-.25
(.37 +/-.01)
"A"
SMA FEMALE CONN MATES NON-DESTRUCTIVELY PER MIL-C-39012
2 PLCS
406.40 +/- 12.7
(16.00 ± .50)
22.9 MAX
(.90)
19.1 MAX
(.75)
7.9 MAX
(.31)
45.2 MAX
(1.78)
14 PIN RIBBON CABLE CONN ANSLEY P/N 609-M145H
BROWN.PIN 14
4-40 UNC-2B x .22 MIN.DP 2 HOLES BOTH SIDES
13.0 +/-.25
(.51 +/-.01)
"B"
"C"

DIM	A	B	C
3-CELL	82.6 (3.25)	76.2 (3.0)	104.6 (4.12)
4-CELL	110.7 (4.36)	103.6 (4.08)	133.6 (5.25)


9.4 +/-.25
(.37 +/-.01)
"A"
SMA FEMALE CONN MATES NON-DESTRUCTIVELY PER MIL-C-39012
2 PLCS
22.9 MAX
(.90)
19.1 MAX
(.75)
7.9 MAX
(.31)
33.5 MAX
(1.32)
45.2 MAX
(1.78)
12 PIN VIKING CONNECTOR P/N TBR12-101P
11.7 MAX
(.46)
4-40 UNC-2B x .22 MIN.DP 2 HOLES BOTH SIDES
13.0 +/-.25
(.51 +/-.01)
"B"
"C"
10.9 MAX
(.43)

DIM	A	B	C
3-CELL	82.6 (3.25)	76.2 (3.0)	104.6 (4.12)
4-CELL	110.7 (4.36)	103.6 (4.08)	133.6 (5.25)

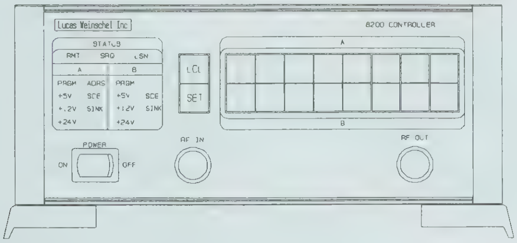
NOTE: ALL DIMENSIONS ARE IN MM (INCHES)
UNLESS OTHERWISE SPECIFIED

ORDERING GUIDE

FREQUENCY RANGE/ VOLTAGE/CONNECTOR	NO. CELLS	ATTENUATOR RANGE/STEP SIZE						
		11/1 dB	15/1 dB	55/5 dB	70/10 dB	75/5 dB	90/10 dB	110/10 dB
dc-4 GHz/+24 V/ Viking Connector	4 3	151-11	151-15	N/A	151-70	151-75	N/A	151-110
dc-18 GHz/+24 V/ Viking Connector	4 3	150-11	150-15	N/A	150-70	150-75	N/A	150-110
dc-26.5 GHz/+24 V/ Viking Connector	4	N/A	N/A	152-55	152-70	N/A	152-90	N/A
dc-4 GHz/+24 V/ Ribbon Cable	4 3	151-11-1	151-15-1	N/A	151-70-1	151-75-1	N/A	151-110-1
dc-18 GHz/+24 V/ Ribbon Cable	4 3	150-11-1	150-15-1	N/A	150-70-1	150-75-1	N/A	150-110-1
dc-26.5 GHz/+24 V/ Ribbon Cable	4	N/A	N/A	152-55-1	152-70-1	N/A	152-90-1	N/A
dc-4 GHz/+5 V/ Viking Connector	4 3	151-11-2	151-15-2	N/A	151-70-2	151-75-2	N/A	151-110-2
dc-18 GHz/+5 V/ Viking Connector	4 3	150-11-2	150-15-2	N/A	150-70-2	150-75-2	N/A	150-110-2
dc-26.5 GHz/+5 V/ Viking Connector	4	N/A	N/A	152-55-2	152-70-2	N/A	152-90-2	N/A
dc-4 GHz/+5 V/ Ribbon Cable	4 3	151-11-3	151-15-3	N/A	151-70-3	151-75-3	N/A	151-110-3
dc-18 GHz/+5 V/ Ribbon Cable	4 3	150-11-3	150-15-3	N/A	150-70-3	150-75-3	N/A	150-110-3
dc-26.5 GHz/+5 V/ Ribbon Cable	4	N/A	N/A	152-55-3	152-70-3	N/A	152-90-3	N/A

ACCESSORIES

CONTROLLER: Using this controller allows the user to control a variety of programmable attenuators, relays, electromechanical switches, and/or TTL compatible devices via either front panel or IEEE-488 GPIB operation. The Model 8200 is capable of driving/controlling 32 push-pull outputs arranged as 16 complementary pairs. The configuration program can also be in an internal non-volatile memory for further use. Using a specially designed mounting Kit these attenuators can be easily installed into the controller.



OPTIONAL CALIBRATION DATA: Calibration Data is available at an additional cost for all programmable step attenuator models. This calibration data is generated using a computer controlled LW Attenuation Measurement System. Standard calibration data can be provided in 250 MHz steps for all dc-4 GHz models and in 500 MHz steps for dc-18 and dc-26.5 GHz models. The measurements are traceable to NIST Standards.

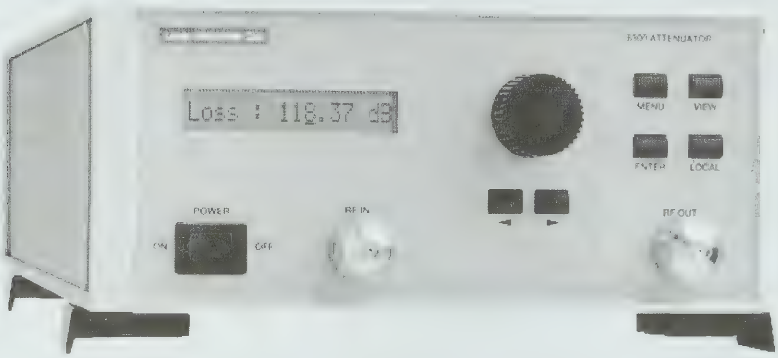
DRIVER BOARD KIT: Lucas Weinschel offers a Driver Board Kit that includes a Driver Board, all the necessary hardware and cabling that can be installed to either side of any 3 or 4 Cell Attenuator. This driver board provides a TTL/CMOS interface and requires +5 V to operate the logic circuits and the appropriate attenuator operating voltage. Order Driver Board Kit using P/N 149-166-1 for 4 cell models and P/N 149-166-2 for 3 cell models.

Lucas Aerospace
Communications & Electronics

Model 8300
PROGRAMMABLE LEVEL SET ATTENUATOR

IEEE - 488

1 WATT



PLANAR CROWN™ CONNECTOR SYSTEM

This versatile **PROGRAMMABLE ATTENUATOR** can be widely used in ATE systems, calibration/engineering labs or even production testing and QA inspection setups. The Model 8300 has many advantages over other electrically switched attenuators, such as:

- The choice of displaying the "NOMINAL" attenuation or the actual "CALIBRATED" value of the setting at any frequency. This provides fast, accurate control of the system RF level.
- Can interpolate and display calibration data for points between standard calibration frequencies. This eliminates the need for extensive look-up tables and manual calculations.
- The attenuator's data may be displayed by using the front panel controls and is available over the GPIB bus. This enables the Model 8300 to be a versatile part of many automated systems.

The Model 8300 has the ability to store and hold calibration data. An enhanced user interface, and digital display allows the operator to dial in the frequency, nominal attenuation setting and then display the actual calibrated value of attenuation, not just individual attenuator cell values. The calibration information is an array of frequency vs attenuation data that is accessible for review by the front panel. The array is stored internally in a nonvolatile memory, allowing for periodic recalibration. This nonvolatile memory has the ability to store and hold approximately 16,000 calibrations.

The GPIB bus (IEEE-488) interface gives both read and write access to the calibration data array, allowing for computer automated calibration setups. The non-volatile memory provides for storage of the calibration frequencies, the characteristic zero insertion loss, and the attenuation data for every cell combination. Other features include:

- PLANAR CROWN™ Connector System
- Choice of Frequency/Attenuation Ranges
- High Accuracy and Repeatability

RACK MOUNTABLE: The Model 8300 can be rack mounted either as a single unit using Rack Mounting Kit (P/N 193-1018) or two Model 8300's can be mounted together using Rack Mounting Kit (P/N 193-1019). Using these kits will allow the Model 8300 attenuator to be mounted in any rack or cabinet that is designed according to EIA RS-310 or MIL-STD-189.

PLANAR CROWN™CONNECTOR SYSTEM: The use of Lucas Weinschel PLANAR CROWN™ connectors at the INPUT and OUTPUT connectors will provide the 8300 user with easy exchange of connector types and eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick replacement of defective connectors. All crowns will mate nondestructively with connectors per MIL-STD-39012 (Refer to the PLANAR CROWN™ data sheet for more details).

Model 8300 Programmable Level Set Attenuator

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

Specification	Model Number 8300-1	 8300-2	 8300-3
Frequency Range	dc-2 GHz	dc-18 GHz	dc-26.5 GHz
Attenuation Range	127/1 dB steps	121/1 dB steps	110/5 dB steps
PLANAR CROWN ™	N-female	SMA-female	SMA-female
Nominal Impedance	50 Ω	50 Ω	50 Ω
RF Input Power	1 Watt avg, 50 W peak (5 microsecond pulse width)	1 Watt avg, 100 W peak (10 microsecond pulse width)	1 Watt avg, 100 W peak (10 microsecond pulse width)
Power Coefficient	0.005 dB/dB/watt	0.001 dB/dB/watt	0.001 dB/dB/watt
Incremental Temp. Coefficient	0.0001 dB/dB/˚C	0.0001 dB/dB/˚C	0.0001 dB/dB/˚C
Rated Life	10 million operations	5 million operations	5 million operations
Repeatability	± 0.06 dB typical	± 0.03 dB typical	± 0.03 dB typ dc-18 GHz ± 0.10 dB typ 18-26.5 GHz
SWR	dc - 1GHz 1.25 1-2 GHz 1.35	dc-4.0 GHz 1.25 * 4.0-8.0 GHz 1.35 * 8.0-12.4 GHz 1.50 * 12.4-18.0 GHz 1.85 *	dc-4.0 GHz 1.20 * 4.0-12.4 GHz 1.35 * 12.4-18 GHz 1.70 * 18.0-26.5 GHz 1.80 *
Characteristic Zero Insertion Loss (dB)	dc-0.5 GHz 3.0 0.5-1 GHz 3.5 1-1.5 GHz 4.5 1.5-2 GHz 5.25	dc-4.0 GHz 8.0* 4.0-8.0 GHz 9.0* 8.0-12.4 GHz 10.0* 12.4-18.0 GHz 12.0*	dc-4.0 GHz 8.0 * 4.0-12.4 GHz 10.0 * 12.4-18 GHz 12.0 * 18.0-26.5 GHz 14.0 *
Calibration Data**	250 MHz steps (909 calibrations)	1 GHz Steps (1638 calibrations)	1 GHz Steps (513 calibrations)
Calibration Range	100 dB	90 dB	90 dB

Calibration Accuracy (±dB):	Frequency Range	Attenuation Setting (dB) 0-50 dB	 51-70 dB	 71-90 dB	 91-100 dB
	dc-4.0	0.21+0.002A	0.23+0.002A	0.27+0.002A	0.37+0.002A
	4.0-8.0	0.29+0.002A	0.31+0.002A	0.36+0.002A	N/A
	8.0-12.4	0.40+0.002A	0.42+0.002A	0.53+0.002A	N/A
	12.4-18.0	0.62+0.002A	0.64+0.002A	0.76+0.002A	N/A
	18.0-26.5	0.75+0.002A	0.77+0.002A	1.10+0.002A	N/A

A= Attenuation Setting in dB

* With 3 dB of internal masking at each port (Input & Output).
** Other calibration data available at additional cost.

Note: Specifications subject to change without notice.

SPECIFICATIONS (CON'T):

TEMPERATURE RANGE:

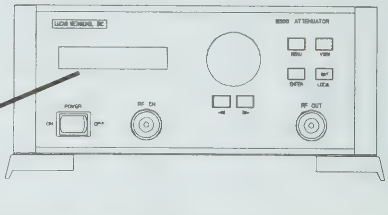
Operating	0° to +50°C (+32° to 104°F)
Storage	-40° TO +75°C (-40° to +167°F)

OPERATING VOLTAGE: 90-130 Vac, 40-63 Hz
180-250 Vac, 40-63 Hz

PHYSICAL:

Weight	Approximately 7 lbs/3.2 kilograms
Height	3.5 in/88.9 mm (with feet installed 4.03 in/102.4 mm)
Width	8.375 in/2127 mm
Depth	13 in/330.2 mm

Displays:



Attn : 75. 00 dB	Displays current Nominal Attenuation value, with cursor at current editing position.
Cal : 75. 36 dB	Displays current Calibrated Attenuation value, with cursor at current editing position.
Loss : 79. 72 dB	Displays current Calibrated Attenuation value plus the insertion loss of the attenuator(s) installed, with cursor at current editing position.
GPIB addr : 03	Displays current GPIB bus address (IEEE-488) with active cursor.
Rng 121.00/1.00	Displays maximum nominal attenuation range and step size parameters for the installed devices.
Attn Disp : Loss	Displays current manner in which the attenuation data will be displayed (Attn, Cal, or Loss).
75.36 dB @ 18.000	Displays the attenuator calibration data for the current attenuation and frequency settings.
Freq : 18.000 Ghz	Displays the selected frequency at which the calibration data will be retrieved.

Coaxial Adapters & Precision Connectors

GENERAL INFORMATION

Lucas Weinschel offers a wide variety of precision SMA, 2.92 mm, Type N, GPC-7, WR-42, and male, female, and sexless combinations of adapters to chose from. Also Lucas Weinschel manufactures precision Type N, Blind Mate Connectors and the **PLANAR CROWN™** UNIVERSAL CONNECTOR SYSTEM. All Lucas Weinschel components are designed and manufactured in-house to obtain low SWR and excellent repeatability over the longest possible operational life. Other features of Lucas Weinschel Adapters and Connectors include:

* **High Repeatability**

* **Quality Connectors** - Lucas Weinschel SMA, Type N, TNC, and 2.92mm connectors are superior connectors which mate nondestructively with connectors per MIL-C-39012. Precision GPC-7 mates with other 7 mm connectors per IEEE-STD-287.

* **Bulkhead Mounting Available**

* **Broad Frequency Range** - Lucas Weinschel Adapters offer a wide selection of frequency ranges from dc to 40 GHz.

* **Custom Designs Available on Request.**

In this section of the catalog, each Adapter and Connector is outlined utilizing individual data sheets containing product features, specifications, and outline drawings. Also these data sheets are preceded by a quick reference guide to help you quickly select the Adapter or Connector that fits your needs. The page number for each Adapter or Connector data sheet is given in the quick reference guide.

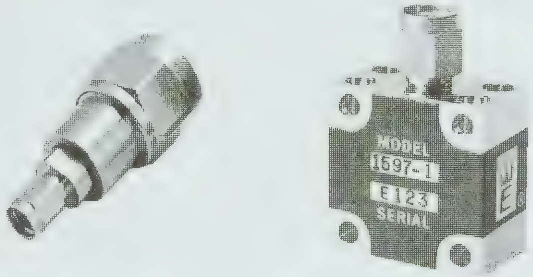
APPLICATIONS

ADAPTERS:

Lucas Weinschel's full line of adapters can be found in numerous OEM, test, R&D, and field applications.

CONNECTORS:

Each type of Lucas Weinschel connector mates nondestructively with counterparts which comply with MIL-C-39012 or IEEE Standard 287.



Type N Connectors - Lucas Weinschel Type N connectors, with a molded inner contact/bead assembly, operate efficiently to 18 GHz. However, many flexible cables such as RG-9/U cannot be used above 17 GHz. Therefore, Weinschel recommends semi-rigid cable with 0.250 inch or 0.141 inch O.D. cable for use to 18 GHz. The Lucas Weinschel Model 1511/1512 is a good example of Lucas Weinschel design. This N Type connector can be easily inserted or removed from semi-rigid cable and provides a maximum SWR of 1.12.

SMA Connectors - Typical commercial SMA connectors may have a useful SWR to 18 or 26 GHz; however, most absorb energy between 22 and 25 GHz due to TEM mode conversion. A mated pair could have between 0.5 dB to 2.0 dB insertion loss. A mated pair of Weinschel Precision Miniature connectors (2.92), which mate with SMA type connectors, have a VSWR of less than 1.25 and an insertion loss of less than 0.5 dB to 26 GHz. The new 2.92 expands this range to 40 GHz.

PLANAR CROWN™ UNIVERSAL CONNECTOR SYSTEM

The Lucas Weinschel PLANAR CROWN™ Universal Connector System incorporates design and application features that eliminate the mechanical, electrical and economical drawbacks of standard bulkhead connectors, connector savers, cable connectors and adapters. In one standard design, it has addressed and resolved major connector related problems faced by users and manufacturers of instruments, cables and components. Other features include an operating frequency range of dc to 40 GHz with 2.92 mm option; ability to maintain calibration integrity when changing connector types; and compatibility with all Type N, TNC, GPC-7, SMA, 2.92 mm, and 2.4mm connectors used throughout the microwave industry.

Coaxial Adapter Quick-Reference Guide

Model Number	Adapter Type	Frequency Range (GHz)	SWR (Maximum)	Insertion Loss (Maximum dB)	Page No.
1568	SMA (F)-SMA (F) Panel Mount (D-Hole)	dc - 26.5	1.20	0.3 - 0.5 *	85
7001	SMA (F)-SMA (F) Panel Mount (D-Hole)	dc - 26.5	1.20	0.3 - 0.5 *	86
F1513 M1513	Type N (F)-Type N (F) Type N (M)-Type N (M)	dc - 18.0	1.15	0.25	87
1587 1588 1589	SMA (F)-SMA (F) SMA (M)-SMA (F) SMA (M)-SMA (M)	dc - 26.5	1.20	0.3 - 0.5 *	88
7002-13 7002-14 7002-23 7002-24	Type N (F)-SMA (F) Type N (M)-SMA (F) Type N (F)-SMA (M) Type N (M)-SMA (M)	dc - 18 GHz	1.12	0.4 - 0.5 *	89
1548-13 1548-14 1548-23 1548-24	Type N (F)-SMA (F) Type N (M)-SMA (F) Type N (F)-SMA (M) Type N (M)-SMA (M)	dc - 18 GHz	1.10	0.43	90
F1566 M1566	GPC-7-SMA (F) GPC-7-SMA (M)	dc - 18.0	1.06	0.43	91
F1567 M1567	GPC-7-Type N (F) GPC-7-Type N (M)	dc - 18.0	1.04	0.43	92
1596-1 1597-1	WR-42-SMA (F) WR-42-SMA (M)	18 - 26.5	1.10	0. 16	93

Connector Quick-Reference Guide:

Model Number	Connector Type	Frequency Range (GHz)	SWR (Maximum)	Cable Type	Page No.
1510	Type N	dc - 18.0	1.12	Special Air Dielectric	94
1511	Type N	dc - 18.0	1.16	0.250" O. D. Semi-rigid	95
1512	Type N	dc - 18.0	1.20	0.141" O. D. Semi-rigid	95
7008	SMA-Blind-Mate Pressurized	dc - 40.0	1.3-1.65*	N/A	96
7009	SMA-Blind-Mate Unpressurized	dc - 40.0	1.3-1.65*	N/A	96

(F) Denotes female connector
(M) Denotes male connector

* Varies with Frequency

Lucas Aerospace
Communications & Electronics

Models 1568 & 1568-1
OEM PRECISION COAXIAL PANEL ADAPTER

dc to 26.5 GHz

Ruggedized SMA Connectors (Female to Female)

FEATURES

- **High Repeatability**.
- **Rugged Injection Molded Connectors**.
- **Bulkhead Mounting** - Conveniently mounts on any panel using a D-hole shown below. Extra heavy construction for long life even with mistreatment makes this adapter suitable for front panel use.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 18	1.15
18 -26.5	1.20

INSERTION LOSS AND REPEATABILITY (dB):

FREQUENCY (GHz)	Ins Loss	Repeatability
dc - 12.4	< 0.20	0.01
12.4 - 18	< 0.25	0.02
18.0 to 26.5	< 0.35	0.02

TEMPERATURE RANGE: -55 °C to +125 °C

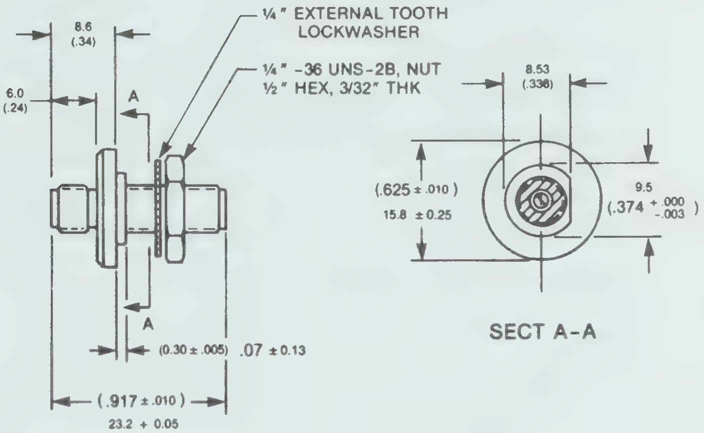
U. S. Patent 4,431,255

CONSTRUCTION: Inner and outer conductors: heat treated beryllium copper, gold plated. Mounting hardware provided (Hex nut and lockwasher) **Add -1** to model number for the optional stainless steel body.

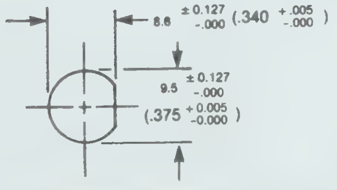
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: 56.7 g (2 oz) maximum

PHYSICAL DIMENSIONS:


¼" EXTERNAL TOOTH LOCKWASHER
¼" -36 UNS-2B, NUT ½" HEX, 3/32" THK
8.6 (.34)
6.0 (.24)
A
A
(0.30 ± .005) .07 ± 0.13
(.917 ± .010) 23.2 + 0.05
8.53 (.336)
(.625 ± .010) 15.8 ± 0.25
9.5 (.374 +.000 -.003)

SECT A-A


8.6 ±0.127 -.000 (.340 +.005 -.000)
9.5 ±0.127 -.000 (.375 +0.005 -0.000)

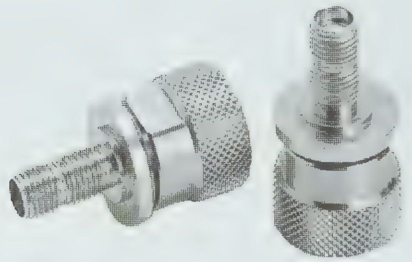
RECOMMENDED MOUNTING HOLE

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Models 7001 & 7001-1
OEM PRECISION COAXIAL PANEL ADAPTER

dc to 26.5 GHz

Ruggedized SMA Connectors (Female to Male)



FEATURES

- **High Repeatability**.
- **Rugged Injection Molded Connectors**.
- **Bulkhead Mounting** - Conveniently mounts on any panel using a D-hole shown below. Extra heavy construction for long life even with mistreatment make this adapter suitable for front panel use.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 18	1.15
18 -26.5	1.20

INSERTION LOSS AND REPEATABILITY (dB):

FREQUENCY (GHz)	Ins Loss	Repeatability
dc - 12.4	< 0.20	0.01
12.4 - 18	< 0.25	0.02
18.0 to 26.5	< 0.35	0.02

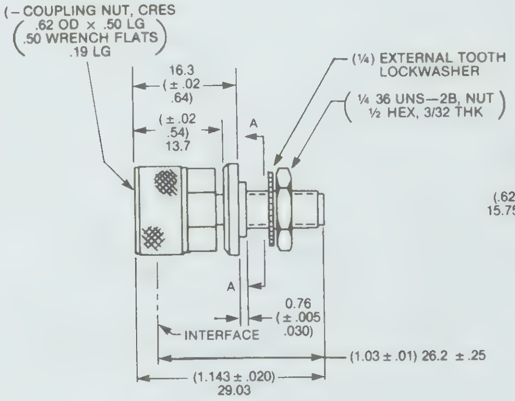
TEMPERATURE RANGE: -55 ˚C to +125 ˚C

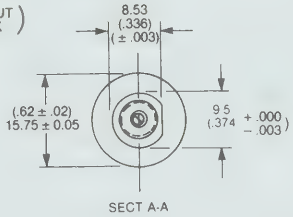
CONSTRUCTION: Inner and outer conductors: heat treated beryllium copper, gold plated. Mounting hardware included **Add -1** to model number for the optional stainless steel body.

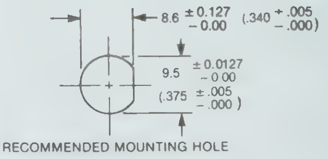
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: 56.7 g (2 oz) maximum

PHYSICAL DIMENSIONS:


(– COUPLING NUT, CRES
(.62 OD × .50 LG
.50 WRENCH FLATS
.19 LG)
16.3
(± .02
.64)
(± .02
.54)
13.7
A
(¼) EXTERNAL TOOTH
LOCKWASHER
(¼ 36 UNS—2B, NUT
½ HEX, 3/32 THK)
A
0.76
(± .005
.030)
INTERFACE
(1.03 ± .01) 26.2 ± .25
(1.143 ± .020)
29.03


8.53
(.336)
(± .003)
(.62 ± .02)
15.75 ± 0.05
9 5
(.374 + .000 − .003)
SECT A-A


8.6 ± 0.127 − 0.00 (.340 + .005 − .000)
9.5 ± 0.0127 − 0.00
(.375 ± .005 − .000)
RECOMMENDED MOUNTING HOLE

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U. S. Patent 4,431,255

Model 1513
PRECISION COAXIAL ADAPTER

dc to 18.0 GHz

Type N to Type N

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 10	1.10
10 - 18	1.15

INSERTION LOSS: 0.25 dB maximum

REPEATABILITY: (Typical) 0.02 dB to 18.0 GHz

TEMPERATURE RANGE: -55 ˚C to +85 ˚C

CONSTRUCTION: Stainless Steel body, beryllium copper, gold plated contacts.

CONNECTORS: Type N per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Select model number as follows:

Model M1513:	male to male
Model F1513:	female to female

WEIGHT: Model M1513: 50 g (1.7 oz) maximum
Model F1513: 40 g (1.4 oz) maximum

FEATURES

- **Low SWR.**
- **High Repeatability**
- **Stainless Steel Construction.**

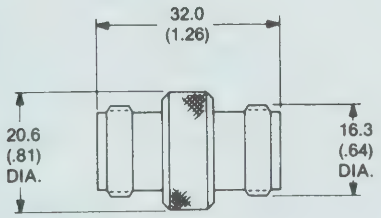
SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

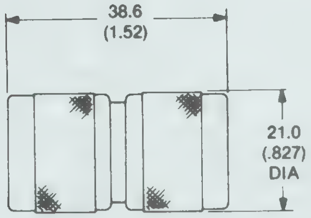
FREQUENCY RANGE: dc to 18 GHz

PHYSICAL DIMENSIONS:

MODEL F1513:



MODEL M1513:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Lucas Aerospace

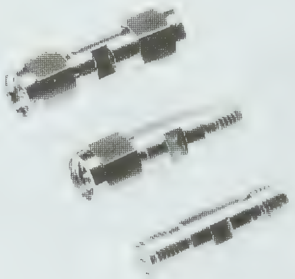
Communications & Electronics

Models 1587,1588,& 1589

dc to 26.5 GHz

PRECISION COAXIAL ADAPTERS

Ruggedized SMA Connectors



FEATURES

- **High Repeatability**.
- **Rugged Injection Molded Connectors.**
- **Designed for Measurement System Use** - Auxiliary wrench flats aid in torquing connections without "chain reaction" loosing of multiple component hookups.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 18	1.15
18 - 26.5	1.20

INSERTION LOSS AND REPEATABILITY (dB):

FREQUENCY (GHz)	Ins Loss	Repeatability
dc - 12.4	< 0.20	0.01
12.4 - 18	< 0.25	0.02
18.0 to 26.5	< 0.35	0.02

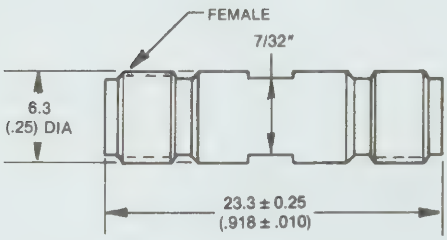
TEMPERATURE RANGE: -55 °C to +125 °C

CONSTRUCTION: Inner and outer conductors: heat treated beryllium copper, gold plated.

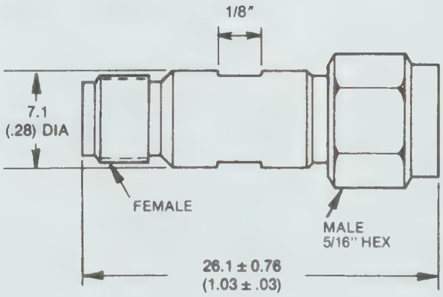
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: 56.7 g (2 oz) maximum

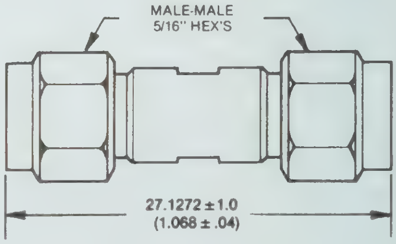
PHYSICAL DIMENSIONS:



MODEL 1587



MODEL 1588



MODEL 1589

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U. S. Patent 4,431,255

Model 7002 dc to 18.0 GHz
HIGH PERFORMANCE COAXIAL ADAPTER

Ruggedized SMA to Type N

INSERTION LOSS AND REPEATABILITY (dB):

FREQUENCY (GHz)	Ins Loss*	Repeatability
dc - 12.4	0.4	0.01
12.4 - 18	0.5	0.02

* Specifications based on mated pair

FEATURES

- **High Repeatability**.
- **Rugged Injection Molded Connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

TEMPERATURE RANGE: -55 °C to +125 °C

ELECTRICAL LENGTH:

Models 7002-14 & 7002-24: 33 mm
Models 7002-13 & 7002-23: 20 mm

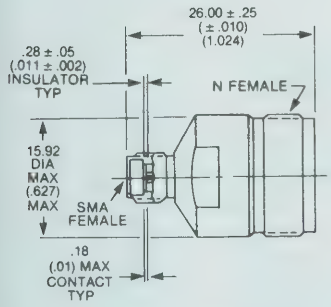
MAXIMUM SWR: 1.12 to 18 GHz (specification based on mated pair terminated in 50 Ω)

CONSTRUCTION: Gold plated beryllium copper center conductors, injection molded into stainless steel outer bodies.

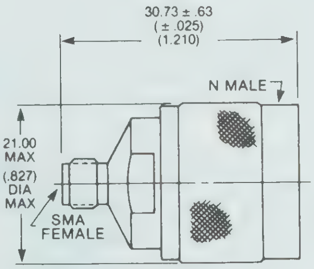
CONNECTORS: Type N and SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: 30 g (1.1 oz) maximum

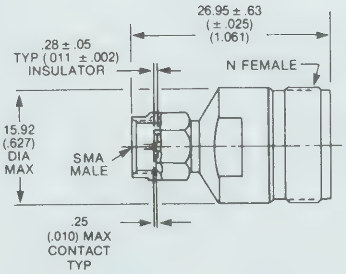
PHYSICAL DIMENSIONS:


26.00 ± .25
(± .010)
(1.024)
.28 ± .05
(.011 ± .002)
INSULATOR
TYP
N FEMALE
15.92
DIA
MAX
(.627)
MAX
SMA
FEMALE
.18
(.01) MAX
CONTACT
TYP

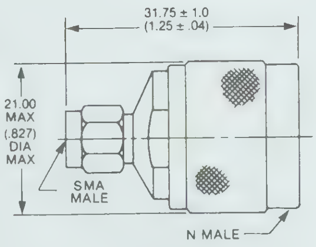
MODEL 7002-13


30.73 ± .63
(± .025)
(1.210)
N MALE
21.00
MAX
(.827)
DIA
MAX
SMA
FEMALE

MODEL 7002-14


26.95 ± .63
(± .025)
(1.061)
.28 ± .05
TYP (.011 ± .002)
INSULATOR
N FEMALE
15.92
(.627)
DIA
MAX
SMA
MALE
.25
(.010) MAX
CONTACT
TYP

MODEL 7002-23


31.75 ± 1.0
(1.25 ± .04)
21.00
MAX
(.827)
DIA
MAX
SMA
MALE
N MALE

MODEL 7002-24

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 1548
PRECISION COAXIAL ADAPTER

dc to 18.0 GHz

Type N to SMA

FEATURES

- **High Repeatability.**
- **Rugged Construction.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

MAXIMUM SWR 1.10 to 18.0 GHz (specification based on mated pair terminated in 50 Ω)

INSERTION LOSS: 0.43 dB maximum (specification based on mated pair terminated in 50 Ω)

REPEATABILITY (dB):

FREQUENCY (GHz)	REPEATABILITY Type N	SMA
dc - 12.4	0.01	0.01
12.4 - 18	0.02	0.02

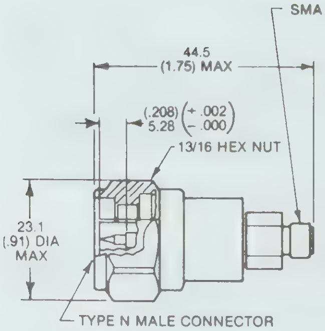
TEMPERATURE RANGE: -55 °C to + 85 °C

CONSTRUCTION: Stainless steel body and coupling nuts. Gold plated beryllium copper center conductors and SMA bodies, injection molded insulators. Coupling Torque: 14 ± 1 inch pounds for Type N and 8 ± 0.5 inch pounds for SMA. Recommended torque wrench Model 1915 for type N connectors only.

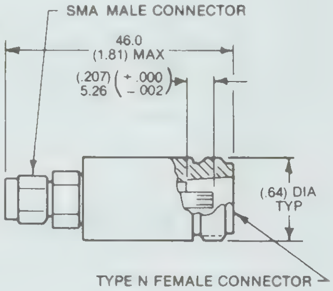
CONNECTORS: Type N and SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: 56.7 g (2 oz) maximum

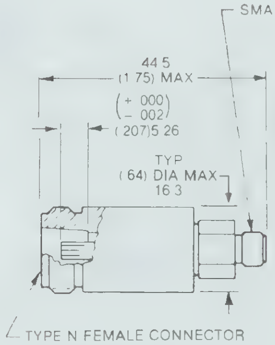
PHYSICAL DIMENSIONS:


SMA FEMALE CONNECTOR
44.5
(1.75) MAX
(.208) (+ .002 / - .000)
5.28
13/16 HEX NUT
23.1
(.91) DIA
MAX
TYPE N MALE CONNECTOR

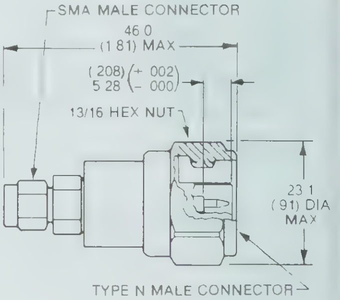
MODEL 1548-14


SMA MALE CONNECTOR
46.0
(1.81) MAX
(.207) (+ .000 / - .002)
5.26
(.64) DIA
TYP
TYPE N FEMALE CONNECTOR

MODEL 1548-23


SMA FEMALE CONNECTOR
44 5
(1 75) MAX
(+ 000 / - 002)
(207)5 26
TYP
(64) DIA MAX
16 3
TYPE N FEMALE CONNECTOR

MODEL 1548-13


SMA MALE CONNECTOR
46 0
(1 81) MAX
(208) (+ 002 / - 000)
5 28
13/16 HEX NUT
23 1
(91) DIA
MAX
TYPE N MALE CONNECTOR

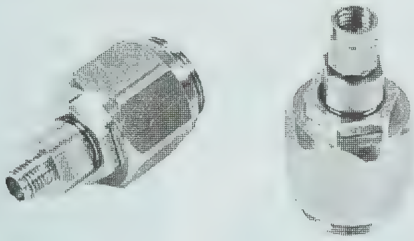
MODEL 1548-24

P. O. Box 6001, Gaithersburg, Maryland 20884-6001
TEL: (301) 948-3434, **800-638-2048**
TELEFAX: 301-948-3625, TLX: 440702

Model 1566
PRECISION COAXIAL ADAPTER

dc to 18.0 GHz

SMA to GPC-7



FEATURES

- **Low SWR** - This adapter provides accurate coupling between sexless precision GPC-7 connectors per IEEE Standard 287 and SMA connectors conforming to MIL-STD-348 test connector.
- **Phase and Attenuation Matched** - Permits interchange of adapters with minimum error when measuring non-insertable devices.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM SWR: 1.06 to 18 GHz (specification based on mated pair)

INSERTION LOSS: 0.43 dB maximum (specification based on mated pair)

REPEATABILITY (dB):

FREQUENCY (GHz)	REPEATABILITY	
	GPC-7	SMA
dc - 12.4	< 0.005	< 0.01
12.4 - 18	< 0.010	< 0.02

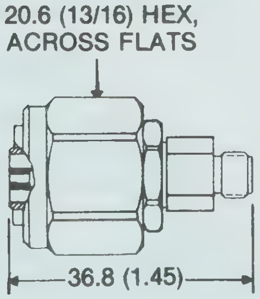
TEMPERATURE RANGE: -55 °C to +85 °C

CONSTRUCTION: Stainless steel body and coupling mechanism; female contact: hardened beryllium copper; male contact: stainless steel; insulation - SMA dielectric - Teflon.

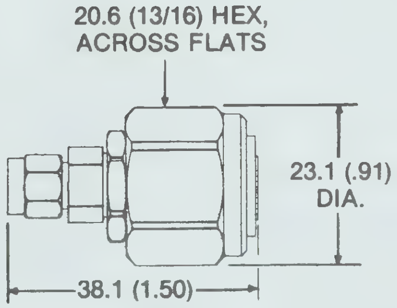
CONNECTORS: Precision GPC-7 connectors mate with other 7 mm connectors per IEEE-287 and SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Coupling Torque: 14 ± 1 inch pounds and 8 ± 0.5 inch pounds for SMA.

WEIGHT:		
	M1566:	56.7 g (2 oz) maximum
	F1566:	48 g (1.7 oz) maximum

PHYSICAL DIMENSIONS:



MODEL F1566



MODEL M1566

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 1567
PRECISION COAXIAL ADAPTER

dc to 18.0 GHz

Type N to GPC-7

FEATURES

- **Low SWR** - This adapter provides accurate coupling between sexless precision GPC-7 connectors per IEEE Standard 287 and Type N connectors conforming to MIL-C-39012.
- **Rugged Construction.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

MAXIMUM SWR:

FREQUENCY (GHz)	SWR*
dc - 4	1.01
4 - 8	1.02
8 - 12.4	1.03
12.4 - 18	1.04

INSERTION LOSS: 0.43 dB maximum (for mated pair).

REPEATABILITY (dB):

FREQUENCY (GHz)	REPEATABILITY GPC-7	 N
dc - 12.4	< 0.005	<0.01
12.4 - 18	< 0.010	<0.02

* Specifications for a mated pair terminated in 50 Ω.

TEMPERATURE RANGE: -55 °C to +85 °C

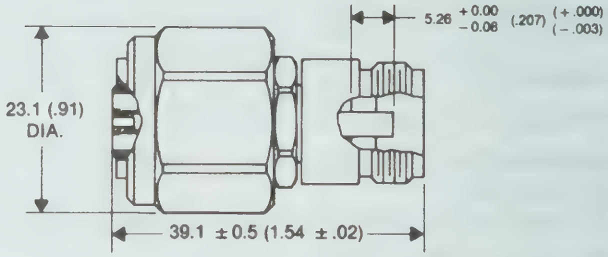
CONSTRUCTION: Stainless steel; female contact - hardened beryllium copper; male contact - stainless steel; insulation - high temperature, low loss machined dielectric.

CONNECTORS: Precision GPC-7 connectors mate with other 7 mm connectors per IEEE-287 and Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Coupling Torque: 14 ± 1 inch pounds.

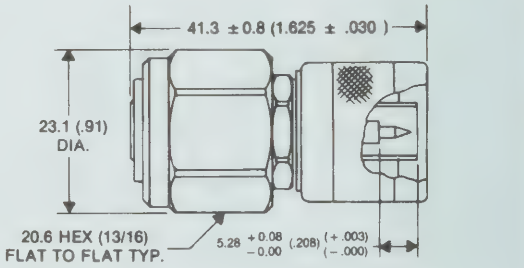
WEIGHT:		
	M1567:	56.7 g (2 oz) maximum
	F1567:	48 g (1.7 oz) maximum

PHYSICAL DIMENSIONS:

Model F1567 (GPC-7 to Type N female)



Model M1567 (GPC-7 to Type N male)

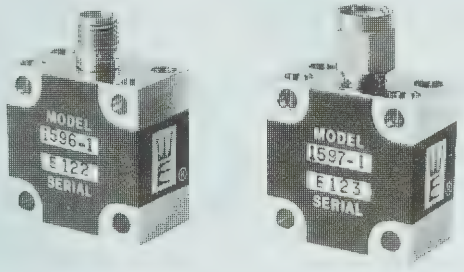


NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Models 1596-1 & 1597-1
WAVEGUIDE-TO-COAX TRANSITIONS

18 to 26.5 GHz

WR-42 to Ruggedized SMA


MODEL
1596-1
E122
SERIAL
MODEL
1597-1
E123
SERIAL

FEATURES

- **Low SWR and Insertion Loss**
- **Excellent Repeatability and Stability** - All external surfaces are gold plated for optimum electrical properties. Injection molded support beads maintain position of coax center conductor and launching probe for improved electrical stability.
- **Ultra Slimline and Lightweight** - Lucas Weinschel Models 1596 and 1597 are ultra compact waveguide-to-coax transitions designed for high package density applications.
- **Rugged Coaxial Connectors** - Lucas Weinschel SMA compatible coaxial connectors incorporate dielectric support beads at the interface which keep the internal surfaces dirt-free and provide a rigid support for the center conductor in both male and female versions. This feature provides longer life and better repeatability then an airline counterpart.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: 18-26.5 GHz

MAXIMUM SWR: 1.10

INSERTION LOSS: 0.16 dB maximum

CONSTRUCTION: Gold plated aluminum housing. Gold plated beryllium copper connector with stainless steel coupling nut.

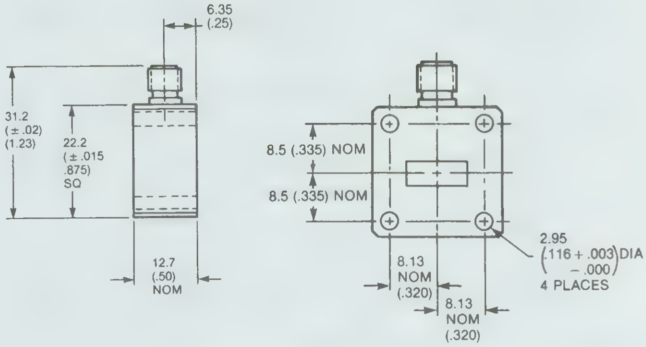
TEMPERATURE RANGE: -40 °C to + 85 °C

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with SMA per MIL-C-39012 and 3.5 mm connectors.

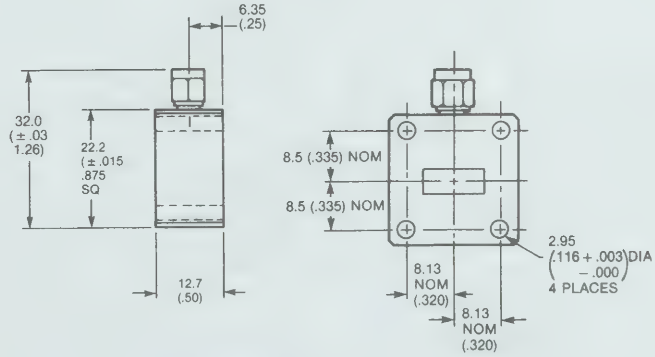
WEIGHT: 19 g (0.7 oz) maximum

PHYSICAL DIMENSIONS:

Model 1596-1 (SMA female to WR-42)


6.35
(.25)
31.2
(± .02)
(1.23)
22.2
(± .015
.875)
SQ
12.7
(.50)
NOM
8.5 (.335) NOM
8.5 (.335) NOM
2.95
(.116 + .003 − .000) DIA
4 PLACES
8.13
NOM
(.320)
8.13
NOM
(.320)

Model 1597-1 (SMA male to WR-42)


6.35
(.25)
32.0
(± .03
1.26)
22.2
(± .015
.875
SQ
12.7
(.50)
8.5 (.335) NOM
8.5 (.335) NOM
2.95
(.116 + .003 − .000) DIA
4 PLACES
8.13
NOM
(.320)
8.13
NOM
(.320)

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 1510
PRECISION TYPE N CONNECTORS

dc to 18.0 GHz

For 7mm rigid coaxial air dielectric lines

FEATURES

- **Stainless Steel Construction** - Increased life and high repeatability are ensured with the use of stainless steel parts. The result is reduced thread wear, chips, and corrosion.
- **High Repeatability Connectors** - Injection molded connector insulators maintain concentricity and provide stable interface dimensions to ensure good life and high repeatability of insertion loss.
- **Panel Mounting Version** - The Model 1510P connector is available with a permanently attached 1-inch square flange for convenient panel mounting.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

SWR: 1.12 maximum (for one connector including transmission line)

TEMPERATURE RANGE: -55 °C to +125 °C

INSERTION LOSS REPEATABILITY (dB):

FREQUENCY (GHz)	REPEATIBILITY
dc - 12.4	better than 0.03 dB
12.4-18	better than 0.05 dB

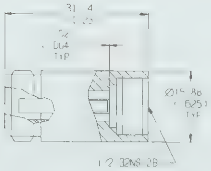
CONSTRUCTION: Body: stainless steel; female contact - hardened beryllium copper; male contact - stainless steel; insulation - high temperature, low loss molded dielectric. Mates nondestructively with MIL-C-39012 Type N connectors.

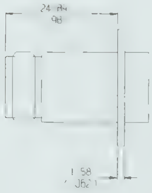
WEIGHT: 43 g (1.5 oz) maximum

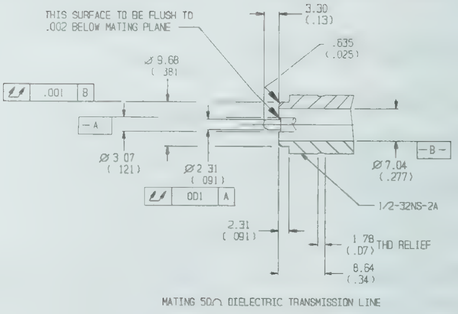
CONFIGURATIONS/ORDERING:

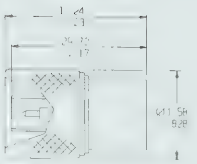
MODEL	CONFIGURATION
M1510	Male connector without flange
F1510	Female connector without flange
M1510P	Male connector with permanent flange
F1510P	Female connector with permanent flange

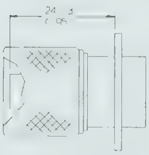
PHYSICAL DIMENSIONS:

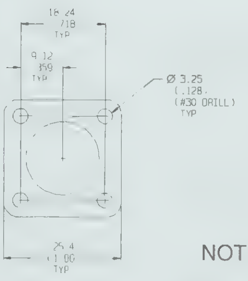

31 4
.52
.004
TYP
Ø15 88
(.625)
TYP
1/2 32NS 2B


24 84
98
1 58
.062


THIS SURFACE TO BE FLUSH TO
.002 BELOW MATING PLANE
3.30
(.13)
.635
(.025)
Ø 9.68
(.381)
.001
B
— A
Ø 3 07
(.121)
Ø 2 31
(.091)
.001
A
— B —
Ø 7.04
(.277)
1/2-32NS-2A
2.31
(.091)
1 78
(.07)
THD RELIEF
8.64
(.34)
MATING 50Ω DIELECTRIC TRANSMISSION LINE






18 24
.718
TYP
9 12
.359
TYP
Ø 3.25
(.128)
(#30 DRILL)
TYP
25 4
(1 00)
TYP

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Lucas Aerospace
Communications & Electronics

Models 1511& 1512

PRECISION TYPE N CONNECTOR

dc to 18.0 GHz

For semi-rigid 0.250 and 0.141 inch O.D. cables

FEATURES

* **High Repeatability Connectors** - Injection molded connector insulators maintain concentricity and provide stable interface dimensions to ensure good life and high repeatability of insertion loss.

* **Stainless Steel Construction** - The use of stainless steel parts reduces thread wear, chips, and corrosion.

* **Panel Mounting Version** - Models M1511P, F1511P, M1512P, and F1512P have permanently attached 1-inch square flanges for convenient panel mounting.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

SWR: Model 1511: 1.16 maximum
Model 1512: 1.20 maximum
(for one connector including transmission line)

INSERTION LOSS: 0.5 dB maximum (specification based on mated pair)

CONFIGURATIONS/ORDERING:

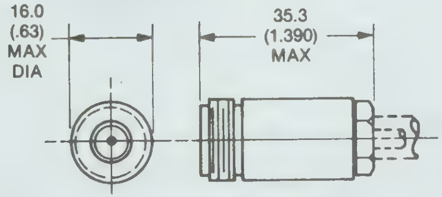
MODEL	CONFIGURATION
M1511 F1511	Type N connector fits 0.250" semi rigid aluminum or copper cable
M1512 F1512	Type N connector fits 0.141" semi rigid aluminum or copper cable
M1511P F1511P	Type N connector with permanent flange fits 0.250" semi rigid copper cable
M1512P F1512P	Type N connector with permanent flange fits 0.141" semi rigid copper cable

CONSTRUCTION: Body: stainless steel; female contact - hardened beryllium copper; male contact - stainless steel; insulation - high temperature, low loss molded dielectric. Mates nondestructively with MIL-C-39012 Type N connectors.

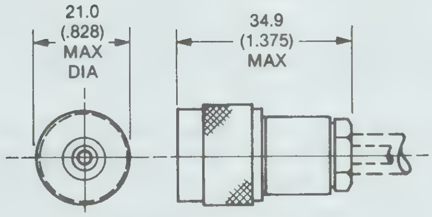
TEMPERATURE RANGE: -55 °C to +125 °C

WEIGHT: 40 g (1.3 oz) maximum

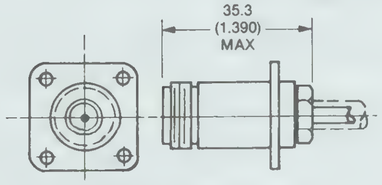
PHYSICAL DIMENSIONS:



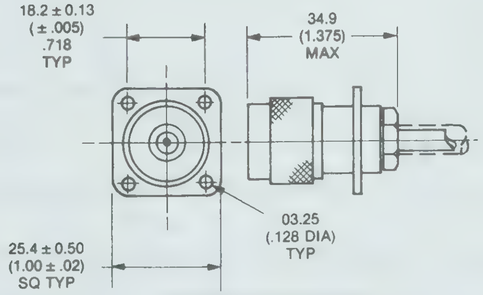
MODEL F1511 & F1512



MODEL M1511 & M1512



MODEL F1511P & F1512P



MODEL M1511P & M1512P

NOTE: All dimensions are given in inches and are maximum, unless otherwise specified.

Models 7008 & 7009

SMA BLIND-MATE CONNECTORS

dc to 40 GHz

Pressurized & Unpressurized

FEATURES

- * **Threadless Connector Mating** - This blind-mate connector series provides threadless connector mating which is useful when mating an array of connectors on one RF module to another array within seconds. Each connector pair will tolerate a radial and axial offset of 0.02 inch and still meet all of its electrical specifications.
- * **Space Saving** - These connectors can simplify RF connections in the most inaccessible regions and high package density systems where conventional coupling connector mating is extremely difficult.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

INSERTION LOSS & SWR:*

FREQUENCY RANGE (GHz)	LOSS (MAX dB)	SWR (MAX)
dc - 18	0.3	1.30
18 - 26.5	0.8	1.40
26.5 - 40	1.5	1.65

* Specifications are for mated pair (Mated pair can be any combination of Model 7008 and 7009).

HYDROSTATIC PRESSURE: 1000 PSI (Model 7008 only)

TEMPERATURE RANGE: -50 °C to +125 °C

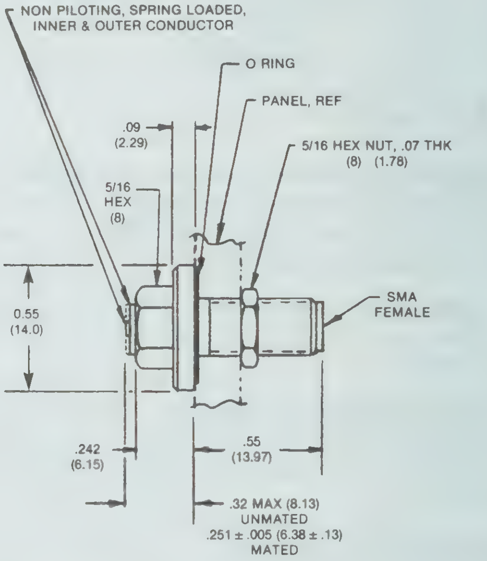
CONNECTORS: Stainless Steel SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

STATIC PRESSURE: 50 PSI (Model 7008 only)

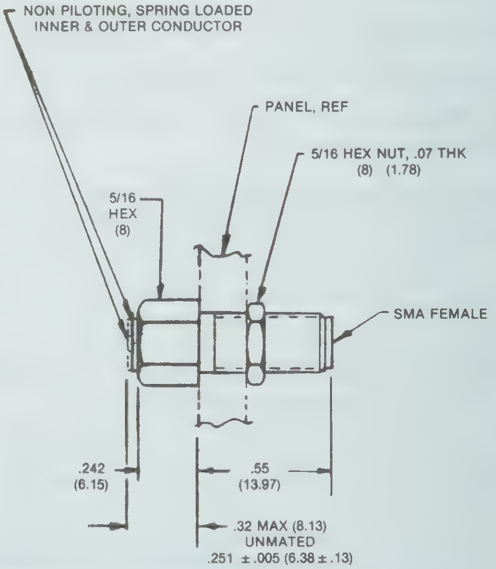
WEIGHT: 2 oz, (56.7 g) maximum

PHYSICAL DIMENSIONS:

Model 7008 (Pressurized):


NON PILOTING, SPRING LOADED, INNER & OUTER CONDUCTOR
O RING
PANEL, REF
.09 (2.29)
5/16 HEX NUT, .07 THK (8) (1.78)
5/16 HEX (8)
SMA FEMALE
0.55 (14.0)
.242 (6.15)
.55 (13.97)
.32 MAX (8.13) UNMATED
.251 ± .005 (6.38 ± .13) MATED

Model 7009 (Unpressurized):


NON PILOTING, SPRING LOADED INNER & OUTER CONDUCTOR
PANEL, REF
5/16 HEX NUT, .07 THK (8) (1.78)
5/16 HEX (8)
SMA FEMALE
.242 (6.15)
.55 (13.97)
.32 MAX (8.13) UNMATED
.251 ± .005 (6.38 ± .13)

NOTE: All dimensions are given in inches and are maximum, unless otherwise specified.

Models 7004A & 7005A dc to 40.0 GHz

Planar Crown™ Universal Connector System

SMA; Type N; GPC-7; TNC; 3.5 mm; 2.92 mm; 2.4 mm

DESCRIPTION

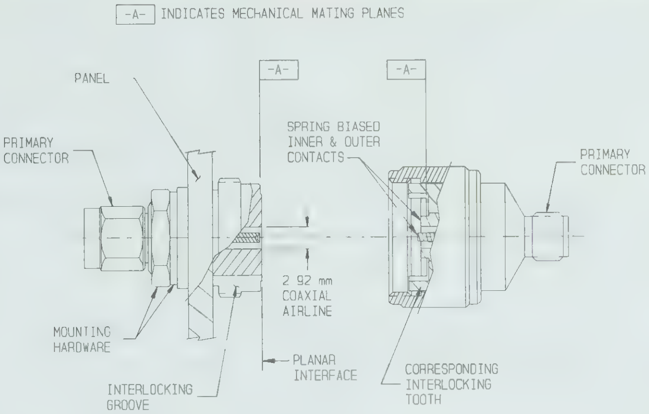
This unique connector system incorporates design and application features that eliminate the mechanical, electrical and economical drawbacks of standard bulkhead connectors, connector savers, cable connectors and adapters. In one standard design, it has addressed and resolved major connector related problems faced by users and manufacturers of instruments, cables and components.

The **Planar Crown™** Universal Connector System is comprised of two connector halves/subassemblies which have a common mating interface referred to as the **Planar Interface. The first connector half** is called the **Planar Bulkhead** which readily mounts into instrument front panels, components and cables. One end of this bulkhead has a 2.92mm male/female **primary** connector. The other end has a combination of grooves, external threads and a coaxial **Planar Interface** with a 2.92mm airline geometry. The bulkhead operates mode free beyond 40 GHz. The **second connector half**, called the **Planar Crown**, has a similar 2.92 mm **Planar Interface** on one end, with spring biased inner and outer contacts. It has corresponding projections which interlock with the grooves on the bulkhead and a coupling nut which secures the two connector halves, resulting in a **non-rotational, torque independent** electrical connection. The spring biased inner and outer contacts eliminate the need for specifying proof torque and no tools are required to make or break the connection. The other end of the **Planar Crown™** is offered in a variety of primary coaxial connector configurations such as SMA, Type N, GPC-7, TNC, 3.5 mm, 2.92 mm and 2.4 mm (under development), thus providing an extremely versatile connector system wherein a connector can be replaced or changed in a matter of seconds.

FEATURES

The use of **Planar Crown™** connectors on instruments, cables, components/accessories offers the manufacturer and user the following benefits.

Reduced Downtime - Damaged connectors can be replaced in seconds without any tools. Repair cost is minimized to that of a single connector. Recalibration, in most applications, is virtually eliminated due to closely matched phase, mechanical dimensions and insertion loss of the replaceable Planar Crown assemblies.



Versatility - Ability to select different connector types adds versatility to instruments, cables, systems and accessories. It offers the end user multiple connector options. Connector type and sex can be readily interchanged as dictated by the system/DUT, eliminating the need for adapters.

Superior Electrical Performance than would be obtained by additional adapters.

Simplified Network and Power Measurements on non-insertable devices.

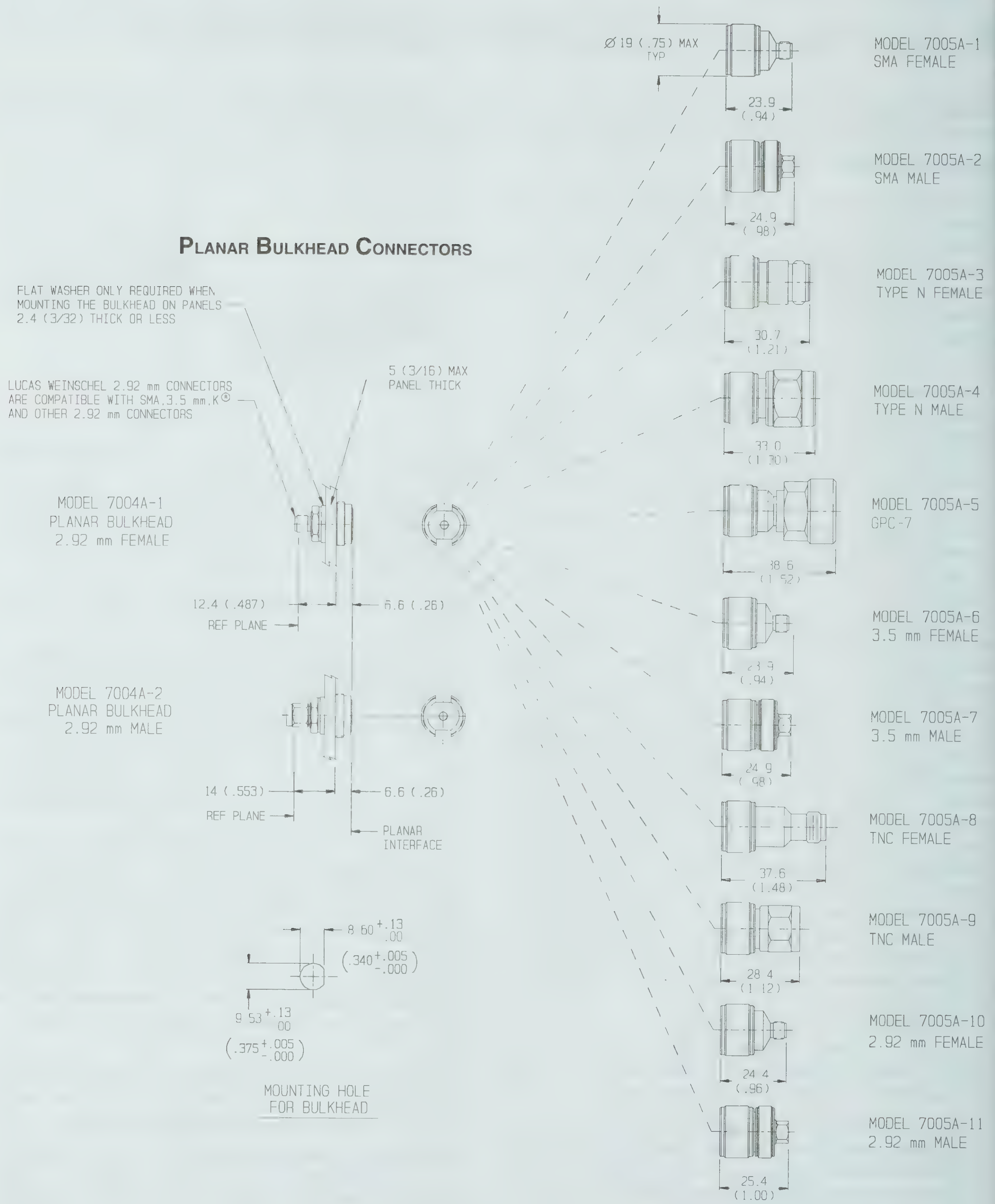
Non-rotational Interface - Since the **Planar Interface** has interlocking teeth, it eliminates unthreading of the connection when the Crown is subjected to a rotational torque. This feature is especially useful on coaxial cables where one end unthreads so easily when the cable is subjected to twisting or flexing.

Torque Independent Connection - A torque wrench is not required when mating the Crown to the bulkhead. A reasonable hand tightening of the coupling nut results in an excellent RF connection. This is achieved by having spring biased inner and outer contacts in the Crown connectors. Spring biasing ensures an intimate electrical contact at the **Planar Interface**. A pilot diameter on the bulkhead guarantees excellent concentricity.

Axial Isolation of the Center Contact - Any excessive axial force on the Crown center contact is absorbed by the spring biasing at the Planar interface end.

Standardized Mounting Holes - All instrument panels can be fabricated with a standard 3/8" Dia. D-hole independent of the front panel connector type/sex. This eliminates changes in sheet metal design when different connector options are requested.

SPECIFICATIONS



PLANAR CROWN CONNECTORS

PLANAR BULKHEAD CONNECTORS

Ø 19 (.75) MAX TYP
23.9 (.94)
MODEL 7005A-1
SMA FEMALE
24.9 (.98)
MODEL 7005A-2
SMA MALE
30.7 (1.21)
MODEL 7005A-3
TYPE N FEMALE
33.0 (1.30)
MODEL 7005A-4
TYPE N MALE
38.6 (1.52)
MODEL 7005A-5
GPC-7
23.9 (.94)
MODEL 7005A-6
3.5 mm FEMALE
24.9 (.98)
MODEL 7005A-7
3.5 mm MALE
37.6 (1.48)
MODEL 7005A-8
TNC FEMALE
28.4 (1.12)
MODEL 7005A-9
TNC MALE
24.4 (.96)
MODEL 7005A-10
2.92 mm FEMALE
25.4 (1.00)
MODEL 7005A-11
2.92 mm MALE
FLAT WASHER ONLY REQUIRED WHEN MOUNTING THE BULKHEAD ON PANELS 2.4 (3/32) THICK OR LESS
LUCAS WEINSCHEL 2.92 mm CONNECTORS ARE COMPATIBLE WITH SMA, 3.5 mm, K® AND OTHER 2.92 mm CONNECTORS
5 (3/16) MAX PANEL THICK
MODEL 7004A-1
PLANAR BULKHEAD
2.92 mm FEMALE
12.4 (.487)
REF PLANE
6.6 (.26)
MODEL 7004A-2
PLANAR BULKHEAD
2.92 mm MALE
14 (.553)
REF PLANE
6.6 (.26)
PLANAR INTERFACE
8.60 +.13 .00
(.340 +.005 -.000)
9.53 +.13 .00
(.375 +.005 -.000)
MOUNTING HOLE FOR BULKHEAD

NOTES: 1. All dimensions are given in mm (inches) and are nominal, unless otherwise specified.
2. K® is a registered trademark of the Wiltron 2.92 mm connector

PLANAR BULKHEAD CONNECTORS

Model Number/ Primary Conn.	Frequency Range (GHz)	SWR* (maximum)	Insertion Loss * (dB maximum)	Electrical Length
7004A-1 2.92 mm Female	dc - 40	----	----	19.9 ± 0.25 mm
7004A-2 2.92 mm Male	dc - 40	----	----	21.6 ± 0.25 mm

PLANAR CROWN CONNECTORS

Model Number/ Primary Conn	Frequency Range (GHz)	SWR (maximum)	Insertion Loss (dB maximum)	Electrical Length
7005A-1 SMA Female	dc - 26.5	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 26.5 GHz)	18.6 ± 0.25 mm
7005A-2 SMA Male	dc - 26.5	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 26.5 GHz)	18.6 ± 0.25 mm
7005A-3 Type N Female	dc - 18	1.20	0.25	18.6 ± 0.25 mm
7005A-4 Type N Male	dc - 18	1.20	0.25	28.6 ± 0.25 mm
7005A-5 GPC-7	dc - 18	1.20	0.25	34.8 ± 0.25 mm
7005A-6 3.5 mm Female	dc - 34	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz) 1.30 (26.5 - 34 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 34 GHz)	18.0 ± 0.20 mm
7005A-7 3.5 mm Male	dc - 34	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz) 1.30 (26.5 - 34 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 34 GHz)	18.0 ± 0.20 mm
7005A-8 TNC Female	dc - 18	1.20	0.25	26.3 ± 0.35 mm
7005A-9 TNC Male	dc - 18	1.20	0.25	28.6 ± 0.35 mm
7005A-10 2.92 mm Female	dc - 40	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz) 1.35 (26.5 - 40 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 26.5 GHz) 0.45 (26.5 - 40 GHz)	18.0 ± 0.15 mm
7005A-11 2.92 mm Male	dc - 40	1.20 (dc -18 GHz) 1.25 (18 - 26.5 GHz) 1.35 (26.5 - 40 GHz)	0.25 (dc -18 GHz) 0.35 (18 - 26.5 GHz) 0.45 (26.5 - 40 GHz)	18.0 ± 0.15 mm

* Specifications based on mated pair of 7004A-X and 7005A-XX. Refer to mating **PLANAR CROWN** for SWR and Insertion loss specifications.

Notes:
1. Lucas Weinschel 2.92 mm connectors are compatible with SMA, 3.5 mm and other 2.92 mm comnnectors.
2. Models 7004A-X and 7005A-XX are **NEW** improved models that are replacing Model 7004-X and 7005-XX. These **NEW** models have superior electrical performance and are offered at a lower cost. Lucas Weinschel will support systems/applications requiring the old model numbers.

U.S. Patent No. 4,836,801
(Other U.S. and Foreign Patents pending)

GENERAL SPECIFICATIONS

PLANAR INTERFACE REPEATABILITY[1]:

Reflection Coefficient (Magnitude):	60 dB (dc - 18 GHz) 50 dB (18 - 26.5 GHz) 45 dB (26.5 - 40 GHz)
Transmission (Magnitude)[2]:	40 dB (dc - 18 GHz) 35 dB (18 - 26.5 GHz) 30 dB (26.5 - 40 GHz)
Transmission (phase)[2]:	0.5 °

1. The Repeatability specifications apply to ten consecutive disconnections and reconnections of the PLANAR INTERFACE.
2.. Transmission repeatability includes the repeatability of the VNA test cable.

OPERATING TEMPERATURE: 0°C to 85°C

CONSTRUCTION: Passivated stainless steel bodies and coupling nuts. Gold plated beryllium copper contacts.

INTERFACE DIMENSIONS & ADDITIONAL FEATURES OF PRIMARY CONNECTORS:

SMA (Models 7005A-1 and -2):

Contact Pin Recession: 0 to 0.1mm (0 to 0.004 in)

Front Insulator Recession: 0.23 to 0.33 mm (0.009 to 0.013 in)

Lucas Weinschel high frequency **SMA** connector operates mode free beyond 26.5 GHz and is a superior SMA connector. It incorporates a wider shoulder on the male and female mating planes (.020" typical compared to .007" on standard SMA connectors) and has a 3 slot female contact instead of the conventional four slot design. Both these features result in a **more rugged connector** with longer life and improved repeatability. Unlike many commercial teflon loaded SMA connectors, these connectors will not cause premature damage when mated with 3.5mm, 2.92mm and K® connectors.

Type N (Models 7005A-3 and -4):

Contact Pin Protrusion (N female): 5.18 to 5.26 mm (0.204 to 0.207 in)

Contact Pin Recession (N Male): 5.28 to 5.36 mm (0.208 to 0.211 in)

The male and female **Type N** connectors are Precision Test connectors per MIL-STD-348. They are usable to 22 GHz.

GPC-7 (Model 7005A-5):

Contact Pin Recession: 0 to 0.05 mm (0 to 0.002 in)

The **GPC-7** connectors are designed per IEEE Std 287.

3.5 mm (Models 7005A-6 and -7):

Contact Pin Recession: 0 to 0.08 mm (0 to 0.003 in)

TNC (Models 7005A-8 and -9):

Contact Pin and Insulator Protrusion (TNC Female): 5.03 to 5.28 mm (0.198 to 0.208 inch)

Contact Pin and Insulator Recession: 5.28 mm (0.208 in) minimum

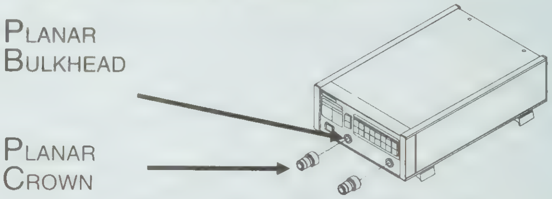
These **TNC** male and female connectors are designed per MIL-STD-348 interface requirements for the **NEW** TNC connectors and operate mode free beyond 18 GHz.

2.92 mm (Models 7005A-10 and -11):

Contact Pin Recession: 0 to 0.08 mm (0 to 0.003 in)

In addition to the many advantages of **2.92 mm** airline connectors the Lucas Weinschel version incorporates a three slot female contact design resulting in a more ruggedized contact than the conventional four slot design on most 2.92 mm connectors.

APPLICATIONS



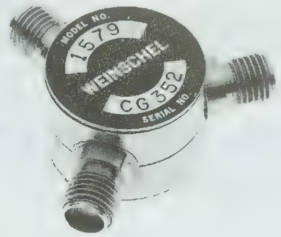
Test Instruments - Synthesizers; network/spectrum analyzers, power meters and many more.

Accessories - Detectors, SWR bridges/autotesters; power sensors, etc.,

Microwave Cables - Cables constructed with the **PLANAR BULKHEAD** connector interface at one end offer the user a wide choice of primary coaxial connectors offered on the **PLANAR CROWN** models. For an instrument such as a VNA, this eliminates the need for having different sets of test cables for different connector configurations. Cables with a built in **PLANAR CROWN** on the opposite end mate directly with **PLANAR BULKHEADS** on instruments, providing an excellent non-rotational electrical connection.

Special Configurations - The **PLANAR BULKHEAD** design can be provided with a built in attenuator or dc block. This is a useful feature when instrument front ends require a masking attenuator or need to be protected against dc voltages. Although the basic mechanical design of the **PLANAR BULKHEAD** was intended for panel mounting, it can be modified to mount directly into other accessories. The primary connector of the bulkhead can also be modified to launch directly on microstrip or suspended stripline substrates.

Power Splitters & Dividers



GENERAL INFORMATION

Lucas Weinschel offers a wide variety of Power Splitters and Power Dividers that operate in the frequency range of dc to 26.5 GHz with many different connector options available. Other features include:

- **Miniature Size and Light Weight.**
- **Quality Connectors** - Lucas Weinschel SMA and Type N connectors are superior connectors which mate nondestructively with connectors per MIL-C-39012. GPC-7 connectors mate with other 7 mm connectors per IEEE-STD-287.
- **Accurate Division** - The balance of power division on the two output arms is 0.25 dB or lower between dc and 18 GHz.
- **Stable** - Low temperature and power coefficients ensure operating stability.

In this section of the catalog, each Power Splitter and Power Divider are outlined utilizing individual data sheets containing product features, specifications, and outline drawings. These data sheets are preceded by a quick reference guide to help you select the Power Splitter(s) and/or Power Divider(s) that fits your needs. The page number for each Power Splitter or Power Divider data sheet is given in the quick reference guide.

APPLICATIONS

Accurate broadband measurements of transmission and reflection parameters are highly dependent on such devices as power splitters and dividers to separate signals for measurement.

POWER DIVIDERS - There are many system applications where a power divider can be used to great advantage, some of which are the design of meticulousness, distribution of a signal to two or more antennas, etc. A well designed power divider is also useful in making laboratory measurements where a reference signal that exactly tracks the measurement signal is required.

POWER SPLITTERS - The Lucas Weinschel resistive power splitters are intended for applications in which one of two outputs are included in a leveling loop or used as a reference in a ratio system, for the purpose of providing an output signal whose source impedance is essentially matched to 50 ohms.

Power Splitters & Dividers Quick Reference Guide

Model Number	Product Type	Connector Type	Frequency Range	Maximum Input Power Cw (W)	Insertion Loss Maximum (dB)	SWR* (50 Ω) (ƒ Maximum)	Page
1579	Splitter	SMA (F) all	dc - 26.5	0.5	8.5	1.35	102
1870A	Splitter	Type N (F) all	dc - 18.0	1	7.5	1.15	103
1872A	Splitter	Type N (F) IN GPC-7 OUT	dc - 18.0	1	7.5	1.15	103
1515	Divider	SMA (M) Input SMA (F) Output	dc - 18.0	1	7.5	1.35	104
1580	Divider	SMA (M) IN SMA (F) OUT	dc - 26.5	1	8.5	1.70	105
1506A	Divider	Type N (M) IN	dc - 18.0	1	7.5	1.35	106

(F) Denotes female connector
(M) Denotes male connector

* Equivalent Source SWR for Splitters

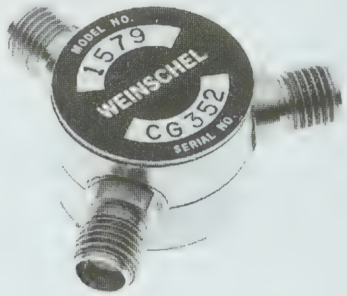
Model 1579

BROADBAND RESISTIVE POWER SPLITTER (MATCHING)

dc to 26.5 GHz

0.5 WATTS

SMA Connectors



FEATURES

These resistive power splitters are intended for applications in which one of the two outputs is included in a leveling loop or is used as a reference in a ratio system, for the purpose of providing an output signal whose source impedance is essentially matched to 50 Ω. Some examples are:

- A dual channel insertion loss measuring system (ratio).
- A parallel IF substitution insertion loss measuring system (ratio or ALC loop).
- A precision power source (ratio or ALC loop).

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

SWR: 1.50 maximum

INSERTION LOSS: 6 dB nominal, 8.5 dB maximum (Between Input and either output)

MAXIMUM INPUT POWER: 0.5 watts CW (input connector only).

OUTPUT TRACKING (Between Ports):

FREQUENCY (GHz)	TRACKING (maximum dB)
dc - 4	0.15
4 - 8	0.20
8 - 18	0.30
18 - 26.5	0.40

EQUIVALENT OUTPUT SWR (Port 2 & 3)*:

FREQUENCY (GHz)	SWR (maximum)
dc - 18	1.25
18 - 26.5	1.35

* When used in a leveling or ratio system.

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

TEMPERATURE RANGE: -55 °C to +125 °C

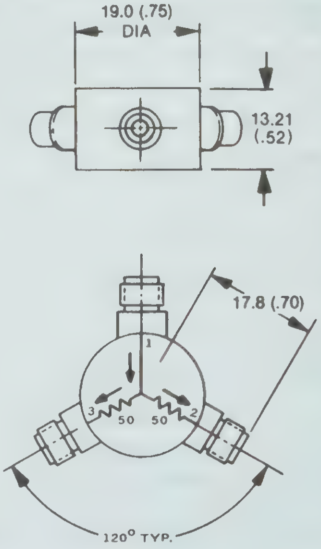
CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Female all ports.

CONSTRUCTION: Gold plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: 30 g (1 oz) maximum

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U.S. Patent No. 4,431,255

Model 1870A & 1872A

BROADBAND RESISTIVE POWER SPLITTERS (MATCHING)

dc to 18.0 GHz

1 WATT

Type N or GPC-7 Connectors

WEINSCHEL
ENGINEERING
GAITHERSBURG
MARYLAND
MODEL
1870A
SERIAL 446A

FEATURES

These Lucas Weinschel Resistive Power Splitters are intended for applications in which one of the two outputs is included in a leveling loop or is used as a reference in a ratio system for the purpose of providing an output whose source impedance is essentially matched to 50 Ω. Some examples are:

- A dual-channel insertion loss measuring system where the resistive power splitter provides a reference and a signal channel for ratio meter.
- A parallel IF substitution insertion loss measuring system where the resistive power splitter provides a sampled output for leveling the signal source.
- A precision power source where a power meter of known characteristics is used, either by ratio or leveling to provide a calibrated output.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

INPUT SWR: 1.30 maximum

INSERTION LOSS: 6 dB nominal, 7.5 dB maximum (Between Input and either output).

MAXIMUM INPUT POWER: 1 watt **average**, 1 kilowatt **peak** (Input connector only)

OUTPUT TRACKING (Between Ports):

FREQUENCY (GHz)	TRACKING (maximum dB)
dc - 8	0.15
8 - 18	0.20

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: <0.0004 dB/dB/˚C

TEMPERATURE RANGE: -55 ˚C to +85 ˚C

EQUIVALENT OUTPUT SWR (Port 2 & 3)*:

FREQUENCY (GHz)	SWR (maximum)
dc - 2	1.05
2 - 4	1.07
4 - 8	1.10
8 - 18	1.15

* When used in a leveling or ratio system. Requires special test methods to verify.

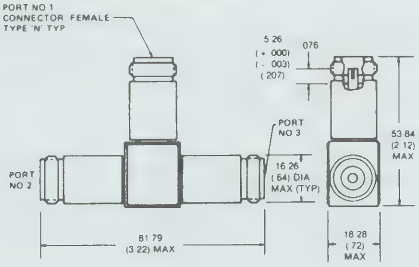
CONSTRUCTION: Nickel plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

CALIBRATION: Test data is available at additional cost.

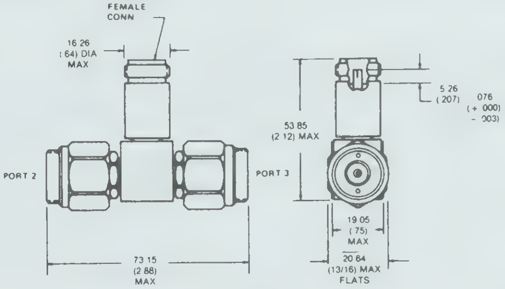
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. GPC-7 Connectors per IEEE-STD-287. Model 1870A contains all Type N female connectors. Model 1872A contains Type N female on input and GPC-7 connectors on outputs.

WEIGHT: Net 170 g (6 oz)

PHYSICAL DIMENSIONS:


PORT NO 1
CONNECTOR FEMALE
TYPE 'N' TYP
5 26
(+ 000)
(- 003)
(207)
076
PORT
NO 3
PORT
NO 2
16 26
(64) DIA
MAX (TYP)
53 84
(2 12)
MAX
81 79
(3 22) MAX
18 28
(72)
MAX

MODEL 1870A


PORT 1
TYPE 'N'
FEMALE
CONN
16 26
(64) DIA
MAX
5 26
(207)
076
(+ 000)
- 003)
53 85
(2 12) MAX
PORT 2
PORT 3
19 05
(75)
MAX
20 64
(13/16) MAX
FLATS
73 15
(2 88)
MAX

MODEL 1872A

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Lucas Aerospace

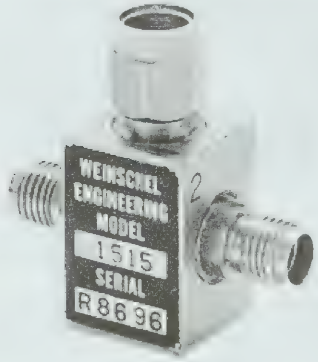
Communications & Electronics

Model 1515
BROADBAND MINIATURE RESISTIVE POWER DIVIDER

dc to 18.0 GHz

1 WATT

SMA Connectors



FEATURES

- **Miniature Size and Lightweight** - High power capability and high ambient temperature operation.
- **Close Tracking and Low Frequency Sensitivity** - Output power symmetry is excellent across the frequency range. Division is 6 dB from matched ports.
- **Calibration Data** - Insertion loss calibration data supplied.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

INSERTION LOSS (between input & either output arm): 6 dB nominal, 7.5 maximum at 18 GHz

MAXIMUM INPUT POWER: 1 watt CW, 1 kilowatt **peak** (5 µsec pulse width)

NUMBER OF PORTS: 3, interchangeable for input and output

AMPLITUDE TRACKING (MAXIMUM):

FREQUENCY (GHz)	TRACKING (maximum dB)
dc - 4	0.2
4 - 10	0.4
10 - 18	0.5

PHASE TRACKING: ± 2 ° nominal between output ports (with male connector as input and female connectors as outputs)

MAXIMUM SWR:

FREQUENCY (GHz)	SWR (maximum)
dc - 10	1.25
10 - 18	1.35

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

DUTY CYCLE: 0.05%

TEMPERATURE RANGE: -55 °C to +125 °C

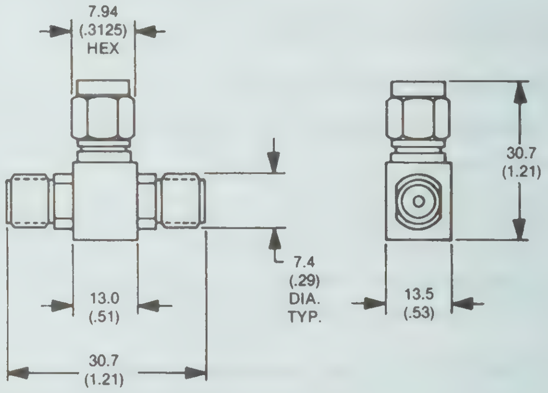
CONSTRUCTION: Nickel plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

CALIBRATION: Insertion loss data supplied at dc, 12.0, and 18.0 GHz. Other test data can be provided at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

WEIGHT: Net 30 g (1 oz)

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U.S. Patent No. 4,431,255

Lucas Aerospace

Communications & Electronics

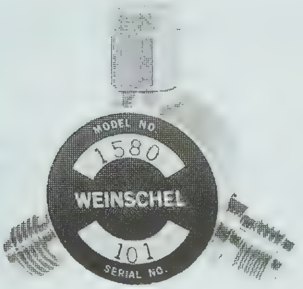
Model 1580

BROADBAND MINIATURE RESISTIVE POWER DIVIDER

dc to 26.5 GHz

1 WATT

SMA Connectors



FEATURES

- **Miniature Size and Lightweight** - High power capability and high ambient temperature operation.
- **Close Tracking and Low Frequency Sensitivity -** Output power symmetry is excellent across the frequency range. Division is 6 dB from matched ports.
- **Calibration Data** - Insertion loss calibration data supplied.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 26.5 GHz

INSERTION LOSS (between input & either output arm): 6 dB nominal, 7.5 maximum to 18 GHz and 8.5 maximum at 26.5 GHz.

MAXIMUM INPUT POWER: 1 watt CW, 1 kW **peak** (5 µsec. pulse width)

NUMBER OF PORTS: 3, interchangeable for input and output

AMPLITUDE TRACKING (MAXIMUM):

FREQUENCY (GHz)	TRACKING (maximum dB)
dc - 18	0.50
18 - 22	0.75
22 - 26.5	1.00

PHASE TRACKING: ± 2° nominal between output ports (with male connector as input and female connectors as outputs)

MAXIMUM SWR:

FREQUENCY (GHz)	SWR (maximum)
dc - 12.4	1.25
12.4 - 18	1.35
18 - 22	1.50
22 - 26.5	1.70

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ ˚C

DUTY CYCLE: 0.05%

TEMPERATURE RANGE: -55 ˚C to +125 ˚C

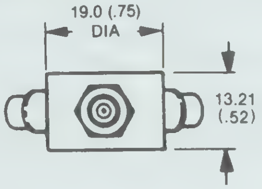
CALIBRATION: Insertion loss data supplied at dc, 12.0, 18.0 and 26.5 GHz. Other test data can be provided at additional cost.

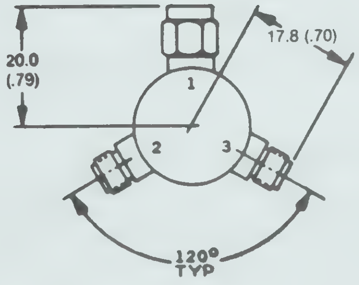
CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Gold plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: Net 30 g (1 oz)

PHYSICAL DIMENSIONS:





NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

U.S. Patent No. 4,431,255

MODEL 1506A
BROADBAND RESISTIVE POWER DIVIDER

dc to 18.0 GHz

1 WATT

Type N Connectors

WEINSCHEL
ENGINEERING
GAITHERSBURG
MARYLAND
MODEL
1506A
SERIAL H 1828

FEATURES

- **Accurate Division and Low Frequency Sensitivity** - The symmetry of output power between the two arms is excellent across the frequency range.
- **High Stability** - Low temperature and power coefficients ensure attenuation stability.
- **Calibration Data** - Each divider is calibrated at four frequencies, and the data are supplied on a permanently attached nameplate.
- **Matched Ports** - Symmetrical 6 dB division permits any port to be used as input.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc-18 GHz

INSERTION LOSS (between input & one output arm): 6 dB nominal, +1.2 dB maximum to 10.0 GHz; +1.5 dB maximum to 18.0 GHz.

MAXIMUM INPUT POWER: 1 watt CW, 1 kilowatt peak (5 µsec. pulse width)

NUMBER OF PORTS: 3, interchangeable for input and output

AMPLITUDE TRACKING (MAXIMUM):

FREQUENCY (GHz)	TRACKING (maximum dB)
dc - 4	0.2
4 - 10	0.4
10 - 18	0.5

PHASE TRACKING: ± 2° nominal between output ports (with male connector as input and female connectors as outputs)

MAXIMUM SWR:

FREQUENCY (GHz)	SWR (maximum)
dc - 10	1.25
10 - 18	1.35

POWER COEFFICIENT: < 0.005 dB/dB/watt

TEMPERATURE COEFFICIENT: < 0.0004 dB/dB/ °C

DUTY CYCLE: 0.05%

TEMPERATURE RANGE: -55 °C to +125 °C

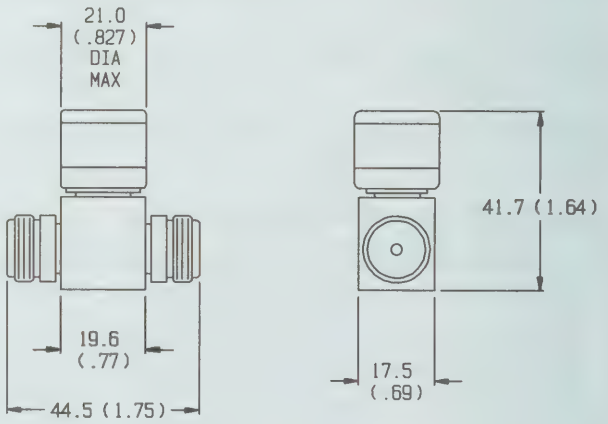
CALIBRATION DATA: Insertion loss at dc, 6.0, 12.0 and 18.0 GHz (Data supplied on permanently attached nameplate). Other test data can be provided at additional cost.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

CONSTRUCTION: Nickel plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: Net 140 g (5 oz)

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Terminations, Loads & Other Coaxial Components

GENERAL INFORMATION

Lucas Weinschel also offers a full line of terminations, loads & other coaxial components (dc blocks and short circuits). These reliable components provide our user with a number of features, such as:

* **High Stability** - The resistive elements used in these terminations are artificially aged and have a low temperature coefficient to provide long-term stability under temperature and humidity.

* **Quality Connectors** - Lucas Weinschel SMA, Type N and TNC connectors are superior connectors which mate nondestructively with connectors per MIL-C-39012. GPC-7 connectors mate with other 7 mm connectors conforming to IEEE-STD-287.

* **Broadband** - Operate in the dc to 18 GHz range.

* **High Repeatability**.

In this section of the catalog, each termination, load and/or component is outlined utilizing individual data sheets containing product features, specifications, and outline drawings. Also these data sheets are preceded by a quick reference guide to help you select the component that fits your needs. The page number for each termination, load, and/or component data sheet is given in the quick reference guide.

APPLICATIONS

TERMINATIONS AND LOADS - Applications for terminations exist in almost every phase of microwave technology from design and measurement to systems. Good terminations are an indispensable aid in making bench measurements on microwave components in the engineering laboratory as those ports of a multiport microwave device which are not involved in the measurement should be terminated in their characteristic impedance in order to ensure an accurate measurement. Many microwave systems employ directional couplers which require terminations on at least one port, and most have various modes of operation or test where terminations are needed on certain terminals.

WEINSCHEL
F1404N
1522

A matched termination of a generalized transmission line is ideally represented by an infinite length of that line having small, but nonzero loss per unit length so that all incident energy is absorbed and none is reflected. Although this type of matched load (termination) was actually used extensively during the early exploration of high frequencies where the wavelength was short enough for the method to be employed, more efficient and practical types of terminations have now been developed.

DC BLOCKS - Lucas Weinschel Inside dc Block contains capacitance in-series with the center conductor to prevent the flow of dc current, while permitting RF power to flow without interruption.

SHORT CIRCUITS - These short circuits are used primarily to establish measurement planes for known reflection phase and magnitude in 50 ohm systems for various connectors.

Terminations & Loads Quick Reference Guide

Model Number	Connector Type	Frequency Range (GHz)	Average Power (W)	Peak Power (kW)	SWR (Maximum)	Page
• F1406A • M1406A	SMA (F) SMA (M)	dc to 18	2	0.5	1.05 + 0.009f (GHz)	109
• F1408 • M1408	SMA (F) SMA (M)	dc to 18	2	0.5	1.04 + 0.006f (GHz)	109
1404N	N	dc to 18	1	1	≤ 1.02 + 0.0023f (GHz)	110
1404WPC	GPC 7	dc to 18	1	1	≤ 1.02 + 0.0011f (GHz)	110
1424	N/TNC/BNC	dc to 12.4	5	5	1.3 (N), 1.4 (TNC/BNC)	111
1425	N/TNC/BNC	dc to 12.4	10	10	1.3 (N), 1.4 (TNC/BNC)	112
1419	SMA	dc to 18	10	1	1.35	113
1418	N	dc to 18	10	1	1.40	114
1426	N	dc to 8	50	5	1.30	115
1428	N	dc to 1.5	150	10	1.10	116

Other Coaxial Components Quick Reference Guide

Model Number	Product Type	Connector Type	Frequency Range (GHz)	Insertion Loss Maximum (dB)	SWR (Maximum)	Page
7003 7006	dc Block	N SMA	0.01 to 21	0.8	1.35	117
F1450 M1450	Short Circuit	N (F) N (M)	dc to 18	- - -	- - -	118
7007	Phase Shifter	SMA	dc to 18	1.0	1.5	119

(F) Denotes female connector
(M) Denotes male connector
• *Express* Shipment Available

Lucas Aerospace
Communications & Electronics

Model 1406A & 1408
SUBMINIATURE COAXIAL TERMINATIONS

dc to 18.0 GHz

2 WATTS

SMA Connectors

EXPRESS
800-542-4457

FEATURES

The Models 1406A and 1408 are general purpose subminiature terminations that operate in the frequency range of dc to 18 GHz but are usable to 26.5 GHz.

* **Low SWR** - The Model 1406A has low VSWR across its operating range (typical SWR is less than specified). The Model 1408 has ultra-low SWR to 18 GHz (usable to 26.5 GHz).

* **Subminiature Size and Lightweight** - All models are approximately 0.5 inches long, and weigh less than 3 grams with male connector and 1.5 grams with female connector.

* **Rugged Construction -** These terminations are made of heat treated beryllium copper with hard gold finish to provide the greatest possible life.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

POWER RATING: 2 watts **average** to 25 ˚C ambient temperature, derated linearly to 0.5 watts @ 55 ˚C. 500 **watts** peak (5 µsec pulse width; 0.2 % duty cycle)

TEMPERATURE RANGE: 54 ˚C to +125 ˚C

MAXIMUM SWR:

Model 1406A:	1.05 + 0.009f (GHz)
Model 1408:	1.04 + 0.006f (GHz)

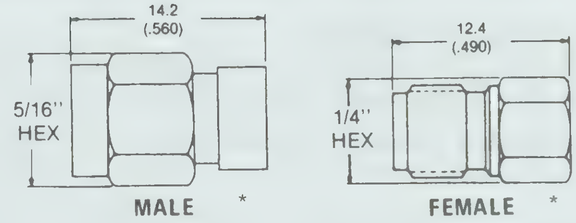
CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Heat treated beryllium copper with hard gold finish.

WEIGHT:		
	Male Connector:	2.8 g (0.1 oz)
	Female Connector:	1.4 g (0.05 oz)

PHYSICAL DIMENSIONS:



* Prefix model number with M for male and F for female.

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

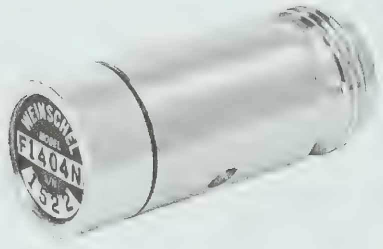
Model 1404N & 1404WPC

PRECISION COAXIAL TERMINATIONS

dc to 18.0 GHz

1 WATT

Type N or GPC-7 Connectors



FEATURES

- **Precision Connectors** - Interface dimensions per MIL-STD-348 Test connectors.
- **Rugged Construction** - Numerically controlled machining is used to produce high quality uniform parts with controlled concentricity and surface finishes. The result is excellent SWR repeatability.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

POWER RATING: 1 watts **average** to 25 °C ambient temperature, derated linearly to 0.1 watts @ 85 °C.
1 kilowatt **peak** (5 µsec pulse width; 0.05 % duty cycle)

TEMPERATURE RANGE: -55 °C to +85 °C

MAXIMUM SWR (For power input not exceeding 100 mW average):

Model 1404N:	≤ 1.02+ 0.0023f (GHz)
Model 1404WPC:	≤ 1.02+ 0.0011f (GHz)

CALIBRATION: SWR test data supplied at 2.0, 4.0, 8.0, 12.0 and 18.0 GHz. Other test data can be provided at additional cost.

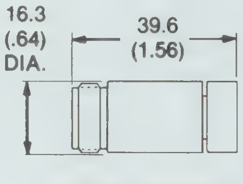
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors (Model 1404N). Choice of male or female connectors. When ordering, prefix model number with M for male and F for female. GPC-7 connectors mate with other 7 mm connectors conforming with IEEE-STD-287.

CONSTRUCTION: Gold plated brass body; stainless steel connectors; gold plated beryllium copper contacts.

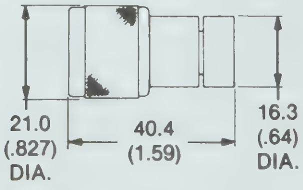
WEIGHT:		
	1404N:	Net, 110 g (4 oz)
	1404WPC:	Net, 90 g (3 oz)

PHYSICAL DIMENSIONS:

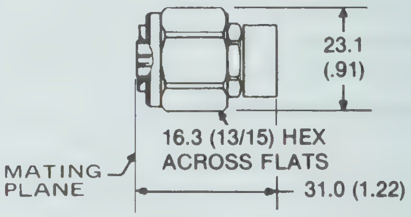
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.



MODEL F1404N



MODEL M1404N



MODEL 1404WPC

Lucas Aerospace
Communications & Electronics

Model 1424
MEDIUM POWER COAXIAL TERMINATIONS

dc to 12.4 GHz

5 WATTS

Type N, BNC, TNC Connectors

FEATURES

- **Connectors Options** - Choice of N, BNC or TNC. Mate nondestructively with connectors manufactured in accordance with MIL-C-39012.
- **Rugged Construction.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 12.4 GHz

POWER RATING: 5 watts **average** @ 25 ˚C ambient temperature, derated linearly to 0 watts @ 125 ˚C.
5 kilowatts **peak** (5 µsec pulse width; 0.05 % duty cycle)

TEMPERATURE RANGE: -55 ˚C to +125 ˚C

MAXIMUM SWR:

FREQUENCY (GHz)	CONNECTOR TYPE N	CONNECTOR TYPE TNC/BNC
dc - 2	1.03	1.10
2 - 4	1.05	1.15
4 - 8	1.15	1.25
8 - 12.4	1.30	1.40

CALIBRATION: SWR test data supplied at dc, 2.0, 4.0, 8.0, and 12.0 GHz. Other test data can be provided at additional cost.

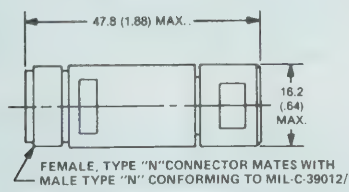
CONNECTORS: Type N, TNC, or BNC connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male
6	TNC, Female
7	TNC, Male
8	BNC, Female
9	BNC, Male

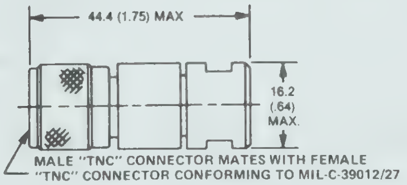
CONSTRUCTION: Stainless steel connectors; gold plated beryllium copper contacts

WEIGHT: Net 60 g (2 oz)

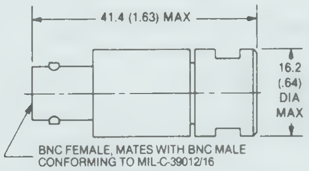
PHYSICAL DIMENSIONS:


47.8 (1.88) MAX.
16.2 (.64) MAX.
FEMALE, TYPE "N"CONNECTOR MATES WITH MALE TYPE "N" CONFORMING TO MIL-C-39012/1

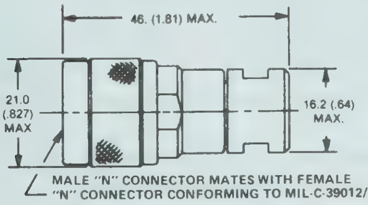
MODEL 1424-3


44.4 (1.75) MAX
16.2 (.64) MAX.
MALE "TNC" CONNECTOR MATES WITH FEMALE "TNC" CONNECTOR CONFORMING TO MIL-C-39012/27

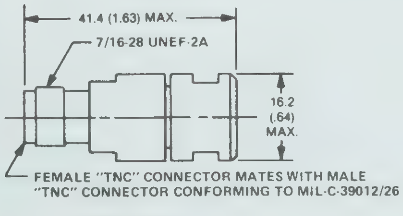
MODEL 1424-7


41.4 (1.63) MAX
16.2 (.64) DIA MAX
BNC FEMALE, MATES WITH BNC MALE CONFORMING TO MIL-C-39012/16

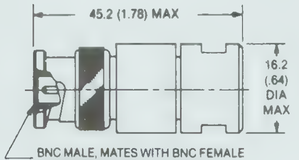
MODEL 1424-8


46. (1.81) MAX.
21.0 (.827) MAX
16.2 (.64) MAX.
MALE "N" CONNECTOR MATES WITH FEMALE "N" CONNECTOR CONFORMING TO MIL-C-39012/2

MODEL 1424-4


41.4 (1.63) MAX.
7/16-28 UNEF-2A
16.2 (.64) MAX.
FEMALE "TNC" CONNECTOR MATES WITH MALE "TNC" CONNECTOR CONFORMING TO MIL-C-39012/26

MODEL 1424-6


45.2 (1.78) MAX
16.2 (.64) DIA MAX
BNC MALE, MATES WITH BNC FEMALE CONFORMING TO MIL-C-39012/17

MODEL 1424-9

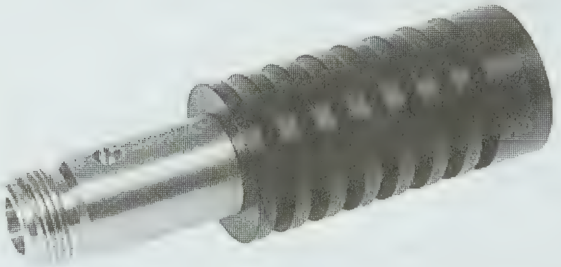
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 1425
MEDIUM POWER COAXIAL TERMINATIONS

dc to 12.4 GHz

10 WATTS

Type N, BNC, TNC Connectors



FEATURES

- **Connectors Options** - Choice of Type N, BNC or TNC - mate nondestructively with connectors manufactured in accordance with MIL-C-39012.
- **Rugged Construction.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: DC to 12.4 GHz

POWER RATING (mounted horizontally): 10 watts **average** to 25 °C ambient temperature, derated linearly to 0 watts @ 125 °C.
10 kilowatts **peak** (5 µsec pulse width; 0.05 % duty cycle).

TEMPERATURE RANGE: -55 °C to +125 °C

MAXIMUM SWR:

FREQUENCY (GHz)	CONNECTOR TYPE	
	N	TNC/BNC
dc - 2	1.03	1.10
2 - 4	1.05	1.15
4 - 8	1.15	1.25
8 - 12.4	1.30	1.40

CALIBRATION: SWR test data supplied at dc, 2.0, 4.0, 8.0, and 12.0 GHz Other test data can be provided at additional cost.

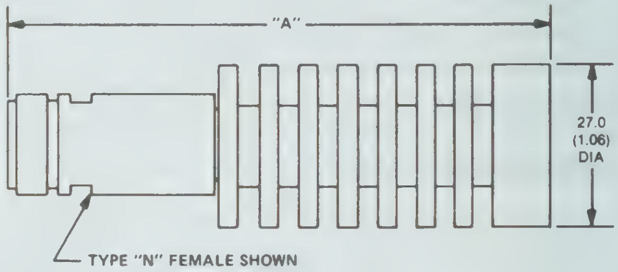
CONNECTORS: Type N, TNC, or BNC connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

Connector Options	Type/Description
3	Type N, Female
4	Type N, Male
6	TNC, Female
7	TNC, Male
8	BNC, Female
9	BNC, Male

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper contacts

WEIGHT: Net 110 g (4 oz)

PHYSICAL DIMENSIONS:



Model #	DIM A	Conn. Type
1425-9	83.82 (3.30)	BNC, male
1425-8	80.01 (3.15)	BNC, female
1425-7	83.06 (3.30)	TNC, male
1425-6	80.01 (3.15)	TNC, female
1425-4	84.58 (3.33)	N, male
1425-3	86.36 (3.40)	N, female

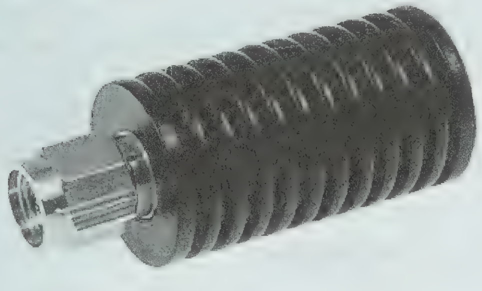
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

Model 1419
MEDIUM POWER COAXIAL TERMINATION

dc to 18.0 GHz

10 WATTS

Ruggedized SMA Connectors



FEATURES

- **Miniature Size and Lightweight** - All models are approximately 1.6 inches long, and weigh less than 14 grams with male connector.
- **Rugged Construction** - Rugged injection molded SMA connectors.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

POWER RATING (mounted horizontally): 10 watts average @ 25 °C ambient temperature, derated linearly to 0 watts @ 125 °C.
1 kilowatts peak (5 µsec pulse width; 0.05 % duty cycle).

TEMPERATURE RANGE: -55 °C to +125 °C

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 8	1.20
8 -12.4	1.30
12.4 - 18	1.35

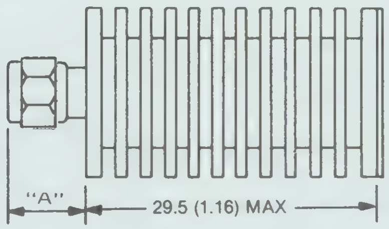
CALIBRATION: Test data is available at additional cost.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper contacts

WEIGHT: Net, 14 g (0.49 oz)

PHYSICAL DIMENSIONS:



Model #	DIM A	Conn. Type
M1419	11.2 (0.44)	SMA, male
F1419	9.4 (0.37)	SMA, female

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

U.S. Patent Nos. 3,157,846 and 3,260,971

Model 1418

MEDIUM POWER COAXIAL TERMINATION

dc to 18.0 GHz

10 WATTS

Type N Connectors

FEATURES

- **Low SWR** - The maximum SWR to 12.4 GHz is 1.25 and 1.40 to 18 GHz. (Calibration data is available upon special request)
- **Rugged Injection Molded Connectors.**

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18.0 GHz

POWER RATING (mounted horizontally): 10 watts average @ 25 ˚C ambient temperature, derated linearly to 0 watts @ 125 ˚C.
1 kilowatt peak (5 µsec pulse width; 0.5 % duty cycle).

TEMPERATURE RANGE: -55 ˚C to +125 ˚C

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.15
4 - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.40

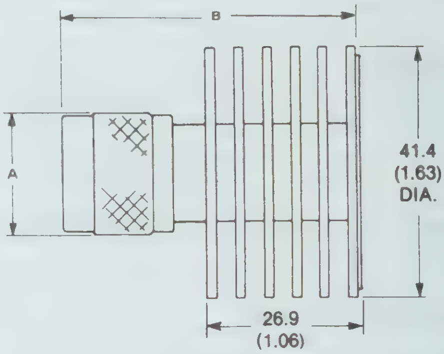
CALIBRATION: Test data is available at additional cost.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: Net, 90 g (3 oz)

PHYSICAL DIMENSIONS:



Model #	DIM A	DIM B	Conn. Type
M1418	21.2 (0.83)	58.8 (2.0)	N, male
F1418	16.3 (0.64)	45.7 (1.8)	N, female

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

Model 1426
HIGH POWER COAXIAL TERMINATION

dc to 8.0 GHz

50 WATTS

Type N Connectors

FEATURES

- **Rugged Construction**.
- **Quality Connectors** - Lucas Weinschel Semi-Precision, stainless steel Type N connectors mate nondestructively with Type N connectors conforming to MIL-C-39012.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 8 GHz

POWER RATING (mounted horizontally): 50 watts **average** to 25 ˚C ambient temperature, derated linearly to 0 watts @ 125 ˚C.
5 kilowatts **peak** (5 µsec pulse width; 0.05 % duty cycle).

TEMPERATURE RANGE: -55 ˚C to +125 ˚C.

MAXIMUM SWR:

FREQUENCY (GHz)	SWR
dc - 4	1.20
4 - 8	1.30

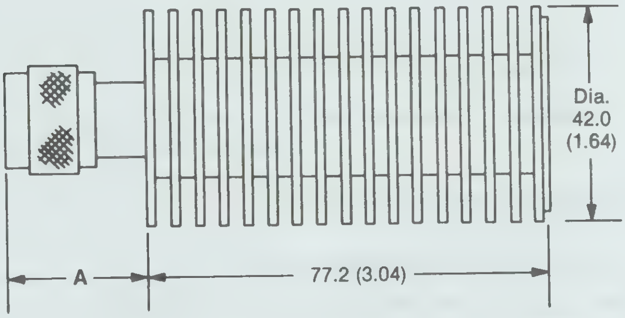
CALIBRATION: SWR test data supplied at dc, 2.0, 4.0, and 8.0 GHz Other test data can be provided at additional cost.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contacts and stainless steal male contacts.

WEIGHT: Net 280 g (10 oz.)

PHYSICAL DIMENSIONS:



Model #	DIM A	Conn. Type
M1426	22.9 (0.90)	N, male
F1426	15.0 (0.59)	N, female

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

U.S. Patents 3,157,846 and 3,260,971

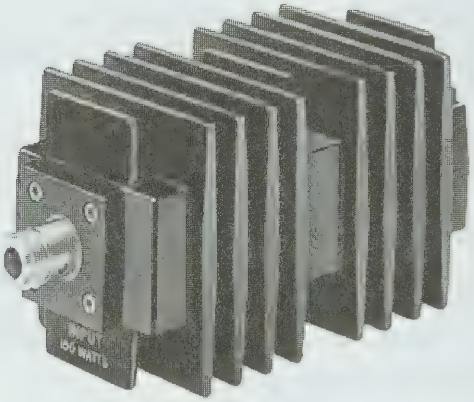
Model 1428

HIGH POWER TERMINATING LOAD

dc to 1.5 GHz

150 WATTS

Type N Connectors



FEATURES

- **Low SWR** - Maximum SWR remains low through full frequency and power range.
- **Rugged Construction** - Quality connectors with special high temperature support beads.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 1.5 GHz

POWER RATING (mounted horizontally): 150 watts **average** @ 25 °C ambient temperature, derated linearly to 15 watts @ 125 °C.
10 kilowatts **peak** (5 µsec pulse width; 0.75 % duty cycle).

TEMPERATURE RANGE: -55 °C to 125 °C.

MAXIMUM SWR: 1.10

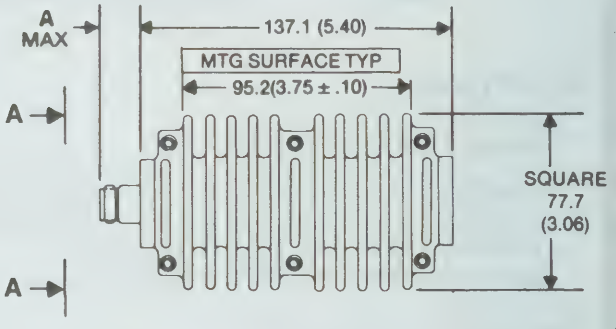
CALIBRATION: SWR test data supplied at 1.5 GHz. Other test data can be provided at additional cost.

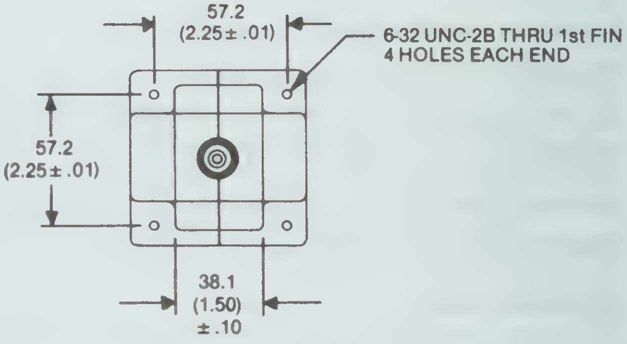
CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Black, finned aluminum body, stainless steel connectors; gold plated beryllium copper female contacts and stainless steel male contact.

WEIGHT: Net 1,130 g (2.5 lb)

PHYSICAL DIMENSIONS:





VIEW A-A

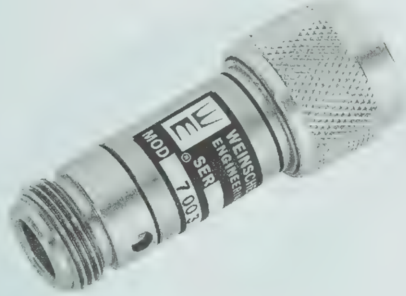
Model #	DIM A	Conn. Type
M1428	22.9 (0.90)	N, male
F1428	15.0 (0.59)	N, female

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified

MODEL 7003 & 7006
INSIDE DC BLOCK

10 kHz to 18 GHz

SMA and Type N Connectors



FEATURES

- **Multi-Octave Bandwidth**
- **Low SWR** - Maximum SWR remains low through full frequency and power range.
- **Rugged Construction** - Lucas Weinschel semi-precision Type N and SMA stainless steel connectors. Molded captive inner contact/bead assembly provides controlled and stable interface dimensions.
- **Usable to 22 GHz**.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: 10 KHz to 18 GHz

SWR: 1.35 maximum (source and load SWR of test system < 1.2)

INSERTION LOSS: 0.8 dB maximum (source and load SWR of test system < 1.2)

VOLTAGE RATING: + 50 Vdc maximum

CALIBRATION: Test data is available at additional cost.

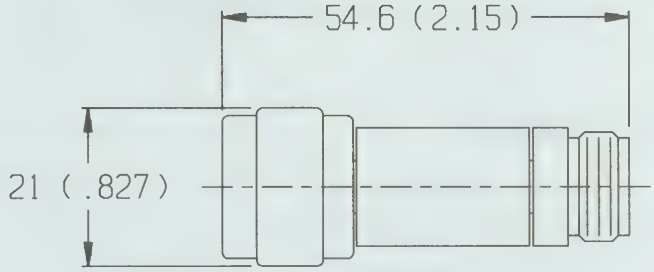
CONNECTORS: Type N (Model 7003) or SMA (Model 7006) connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Standard unit has one male and one female connector. Add Prefix M for double male and F for double female connectors.

CONSTRUCTION: Stainless steel body and connectors; gold plated beryllium copper contacts

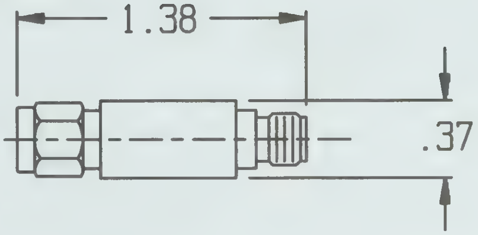
WEIGHT: Net: 67 g (2.4 oz)

PHYSICAL DIMENSIONS:

Model 7003:



Model 7006:



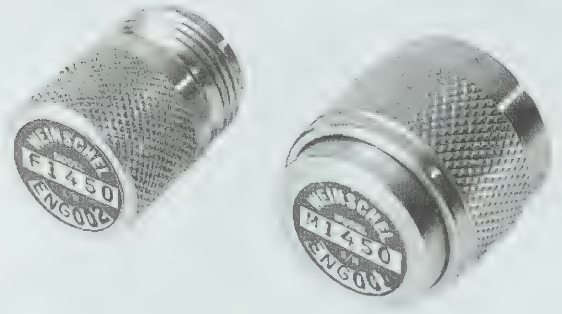
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 1450

SHORT CIRCUIT

dc to 18 GHz

Type N Connectors


WEINSCHEL
F1450
ENG00
WEINSCHEL
M1450
ENG00

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 18 GHz

REFLECTION: 100%, nominal

CALIBRATION: No test data available.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors. Choice of male or female connectors. When ordering, prefix model number with M for male and F for female.

CONSTRUCTION: Stainless steel connectors; gold plated beryllium copper contacts.

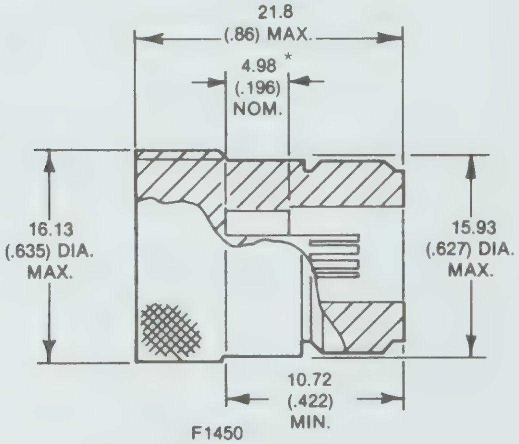
WEIGHT:	F1450:	Net 25.37 g (0.90 oz)
	M1450:	Net 31.47 g (1.1 oz)

FEATURES

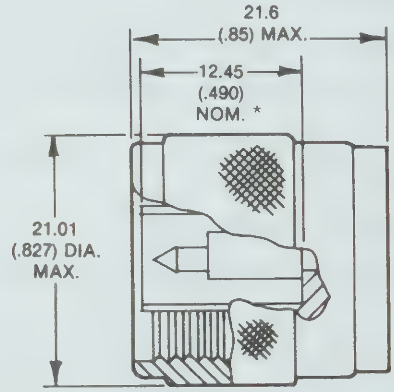
- **Excellent Repeatability**
- **Defined Reference Planes**
- **Rugged Construction**

PHYSICAL DIMENSIONS:

* These dimensions refer to the location of the short circuit plane from the reference plane.


21.8
(.86) MAX.
4.98 *
(.196)
NOM.
16.13
(.635) DIA.
MAX.
15.93
(.627) DIA.
MAX.
10.72
(.422)
MIN.

F1450
FEMALE


21.6
(.85) MAX.
12.45
(.490)
NOM. *
21.01
(.827) DIA.
MAX.

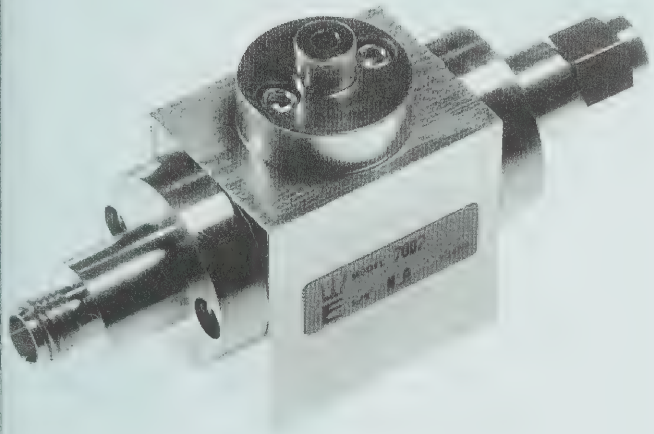
M1450
MALE

NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Model 7007 COAXIAL IN-LINE PHASE SHIFTER

dc to 18.0 GHz

Ruggedized SMA Connectors



SPECIFICATIONS

INCREMENTAL PHASE SHIFT: Adjustable to 200° @ 18 GHz; 100° at 9 GHz.

RESOLUTION: 0.5 ° per turn per GHz, typical (Adjustment shaft has 20 turns for full range).

INSERTION PHASE: 1600 ° @ 18 GHz (Typical)

PHASE VS FREQUENCY: Nominally linear response

INSERTION LOSS: 0.5 dB typical (1.0 dB maximum)

MAXIMUM SWR: 1.5

POWER RATING: 200 watts average

TEMPERATURE RANGE: -55 °C to 125 °C.

CALIBRATION: No test data available.

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

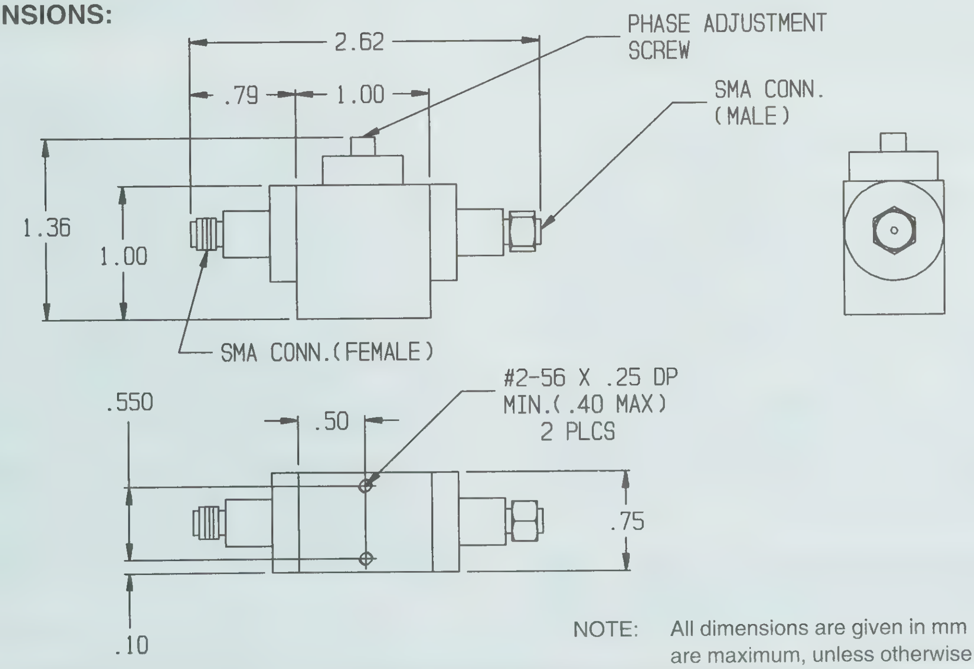
CONSTRUCTION: Aluminum body, stainless steel connectors; gold plated beryllium copper contacts.

WEIGHT: 63 g (2.3 oz)

FEATURES

- **Linear** - Provides a linear adjustable phase shift to 18 GHz in a very small in-line coaxial package.
- **Usable to 20 GHz**

PHYSICAL DIMENSIONS:



NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

Lucas Weinschel Services

Besides providing high quality RF and microwave components and instruments to our customers, Lucas Weinschel offers a number of other in-house services to its customers, such as:

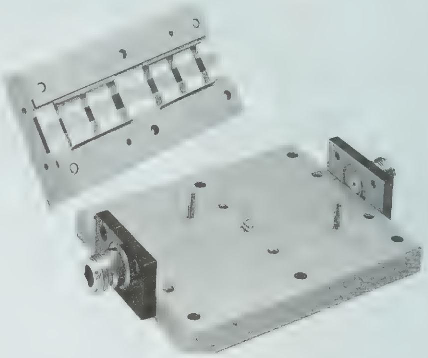
- Custom Product Design
- High Reliability Products
- Manufacturing Engineering
- Precision Machining and Sheet Metal Fabrication (with Model Shop)
- Plating
- Injection Molding
- Industrial Painting
- Test and Service
- Microwave Integrated Circuit (MIC) Design and Manufacturing

Custom Product Design:

Custom designed products have been a large part of Lucas Weinschel's business for over 38 years. The majority of these customized products produced at Lucas Weinschel are the result of adapting a standard or generic product to specific customer needs or requirements. This process provides our customers with reliable, quality products at low competitive prices to meet those just-in-time deliveries. Our experienced group of engineers is fully capable of designing and delivering products that will satisfy most customer requirements. Some examples of these custom products are:

- **Medium And High Power Attenuators**
  - **Compact 50 Watt Unit:** Compact 50 watt units may be integrated with other components of a system on a common heat sink (mounting plate). "Drop-in" versions for microstrip and stripline mediums are also available and are provided with .050 inch diameter x .380 inch long solder tabs.
  - **200 Watt Field Adjustable:** A 200 watt field-adjustable attenuator to discretely change the output power of a transmitter in specified "dB" steps. Attenuator cards are provided in kit form to customer requirements.
  - **400 Watt Narrow-Profile Attenuators** - High power narrow-profile attenuators have been designed to meet particular customer size and electrical specifications.

INPUT
CAUTION



- **Programmable Attenuators:**
  - **Four Cell Units:** Lucas Weinschel has designed and manufactured several different attenuation ranges and step sizes that operate in frequency ranges from dc to 26.5 GHz, such as:

    0 - 15 in 1 dB steps: (1,2,4,8 dB cells)
    0 - 70 in 10 dB steps: (10,20,20,20 dB cells)
    0 - 100 in 10 dB steps: (10,30,30,30 dB cells)
  - **Floating Ground** - In the floating ground configuration, the relay coils are decoupled from the case ground and the control terminals are totally isolated from the RF ground. Also available are units utilizing internal diodes for coil transient suppression.
  - **TTL Compatible:** Five and eight cell units have been developed with interface boards mounted on top. The units are supplied with mating wire harness for the 15-pin miniature D connector on the PC board (Adapted from Model 3200).
- **OEM Step Attenuators (Manual and Motorized):**
  - **Frequency Ranges:** dc - 18 GHz, dc - 26.5 GHz, and dc - 40 GHz.
  - **Attenuation Ranges:** 0 - 9 in 1 dB steps, 0 - 90 in 10 dB steps, and 0 - 60 dB in 10 dB steps.
  - Make-before-break contacts eliminate loss of signal during switching.

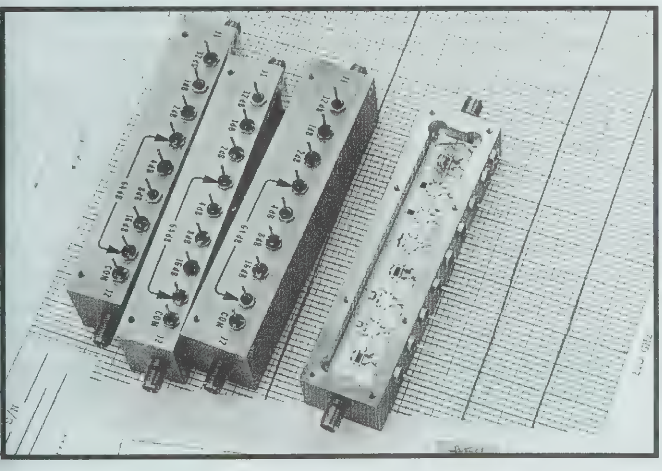
High Reliability Products:

Lucas Weinschel has developed this program to meet or exceed many high reliability requirements imposed by both Government and commercial customers. Using Lucas Weinschel's extensive in-house capabilities allows our **High Reliability** Group to comply with most of the requirements of MIL-Q-9858, MIL-I-45208 and MIL-C-45662.

Improved product reliability is an evolving concept which benefits both the client and Lucas Weinschel. Lucas Weinschel designs many of its **High Reliability** components to meet MIL-A-3933 and MIL-T-945. Also a major share of Lucas Weinschel connectors and components used in these **High Reliability Products** are inspected and tested to MIL-A-3933.

A Hi-Rel component always involves additional care, handling, quality control, inspection and testing. This means more time and attention is required to produce a Hi-Rel component, but it is well worth the effort for a superior product. All Hi-Rel assembly and testing are performed in a separate area by Lucas Weinschel assemblers assigned only to Hi-Rel components. However, all fabrication, routine processing and handling (unless specified otherwise by the client) are performed in the same manner as for all standard catalog equipment according to Lucas Weinschel's high standards. All Lucas Weinschel components are designed with high reliability in mind.

Most Lucas Weinschel attenuators and terminations can be supplied to customer specified environmental requirements. Additionally they can be provided to meet the requirements of MIL-A-3933 (fixed), MIL-A-24215 (variable) or MIL-D-39030 (terminations).



Hi-Rel units can be laser-marked and are manufactured from materials which have a TML of less than 1% and CVCM less than 0.1%.

Manufacturing Engineering:

Specializes in value engineering, design reviews, process control documentation, and acceptance test procedure (ATP's) development to customer and MIL-SPEC requirements.

Manufacturing Engineering can also provide extensive assistance to customers in product development, fabrication, stress screening, environmental testing, reverse engineering capabilities, and MIL-A-3933 qualification. Environmental testing includes: salt spray, vibration/shock, burn-in, hot and cold environmental chambers, humidity testing, life cycle testing, to comply with portions of MIL-STD-202.

Precision Machining and Sheet Metal Fabrication (with Model Shop):

Precision machining and custom sheet metal fabrication services produce the necessary components from raw material for production and prototype requirements within Lucas Weinschel as well as projects for a diverse customer base. This is accomplished by a team of highly skilled craftsmen using state-of-the-art equipment. These craftsmen are dedicated to close tolerance machining and fabrication with "just-in-time deliveries," fast turnaround, working to customer's drawings or sketches while meeting the requirements of MIL-I-45208A. Equipment and capabilities include:

* Precision turning and milling NC, CNC, and Manual Equipment.
* Matsuura MC1000 CNC machining center with 25 station tool changer
* Takisawa MAC-V2E CNC machining center with 24 station tool changer.
* Custom Sheet Metal Fabrication
* Strippit FC1000 sx CNC turret punch - punching force of 30 metric tons, punches mild steel 10 1/4" thick, maintains accuracies of ± 0.004 at up to 300 hits per minute.
* Diacro VT19 NC turret punch with 18 stations.

Plating:

Lucas Weinschel's Electroplating Shop can provide capabilities for performing plating to many commercial and military specifications such as:

- * Gold plating per MIL-G-45204.
- * Passivation on Stainless steel per QQ-P-35C.
- * Electroless Nickel per MIL-C-26074.

Injection Molding:

At Lucas Weinschel, injection molding is just one of the innovative steps used in the fabrication process to provide our customers with the best connectors money can buy. The use of injection molding enables greater design flexibility and provides for consistent quality. Injection molding equipment and capabilities include:

- * 3-15 ton boy machines
- * 1-2 ton boy machine with heater and dryer, plus vacuum oven for annealing.

Industrial Painting:

Industrial painting can be performed to many Federal, Military specifications and customer defined requirements.

Test and Service:

Lucas Weinschel is committed to providing fast, professional customer service and support world wide. You have the assurance of knowing that a staff of highly trained professionals are available using approved procedures and instrumentation. The Lucas Weinschel Test and Service Department is always committed to quality as defined by the customer. A full line of repair and calibration services are available and include:

- * **Calibration** - Traceable to National Standards (NIST)
- * **MIL-STD-45662A Calibration** - Lucas Weinschel can provide service and documentation meeting MIL-STD-45662A. There is an extra charge for the additional documentation and responsibilities associated with this service.
- * **Test Data** - Before and after test data is available at a nominal charge. Special and/or additional test data at a nominal charge.

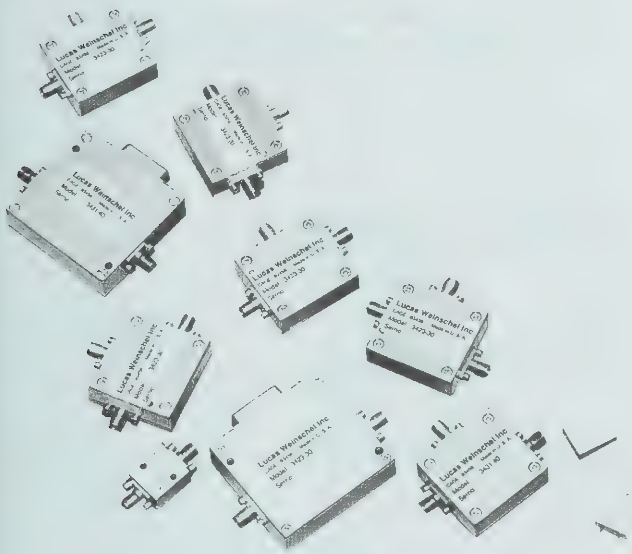
- * **REPAIR WORK** - Accomplished repairs will return the item to its published specifications. Lucas Weinschel provides a 90 day warranty on repair service performed. With fixed price repairs on most products.
- * **Module Exchange** - Most Lucas Weinschel instruments are supported by a module exchange program. For additional information on the module exchange service, please contact Lucas Weinschel.
- * **Telephone Consultation** - Our service department will gladly provide informal consultation over the telephone to customers with service questions.
- * **Repair Parts** - Lucas Weinschel maintains a spare parts inventory. If you require assistance identifying the item contact Lucas Weinschel. Lucas Weinschel also offers recommended spare parts and service kits.
- * **Training** - Training is essential to obtain maximum performance from your Lucas Weinschel product. Customer tailored training in both operation and maintenance is available to meet each customer's specific needs. These courses generally last one week per product and may be scheduled either at Lucas Weinschel or at the customer's site.

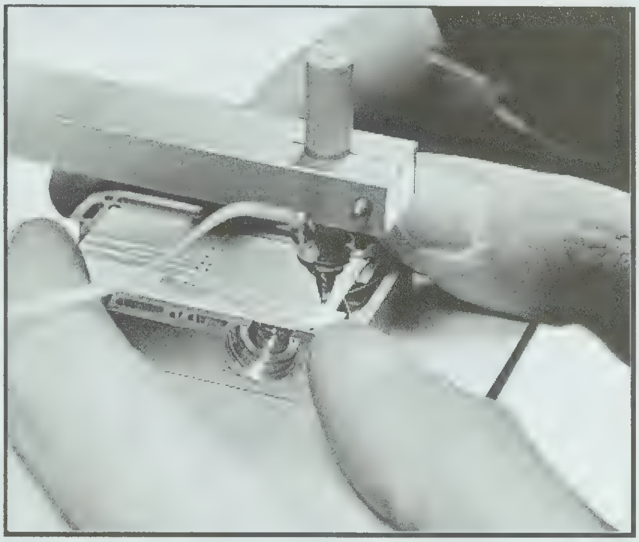
Microwave Integrated Circuit (MIC) Design:

The MIC Group was established primarily to provide components for Lucas Weinschel instruments. This Group has been instrumental in enabling Lucas Weinschel to produce high quality instruments. In addition, this Group supplies Lucas Weinschel customers with standard or custom MIC components, primarily PIN diode attenuators (refer to examples on pages 123 through 126) to complement our standard line of fixed and mechanically variable attenuators.

There is a wide range of MIC components that have been designed by the Group and used in Lucas Weinschel designed and manufactured instruments. Typical examples are mixers from 2 to 18 GHz, various YIG oscillators covering octave and multi-octave bands from 0.5 to 10 GHz, frequency samplers to 12 GHz, frequency doublers to 20 GHz and directional couplers to 26 GHz.

In addition, we have also developed a range of PIN diode attenuators. Designs have been made from 1 to 12.4 GHz in octave bandwidths. The technology involves either continuously variable PIN diodes or PIN diode switched attenuator pads. PIN attenuators have been produced with attenuation ranges up to 96 dB. Such large attenuation ranges have been made possible by the use of the Lucas Weinschel attenuation measurement systems to verify the attenuation accuracy.





A full range of equipment is available to support the development and manufacture of MIC components. The new designs are simulated using modern computer software. Masks are then also computer generated and photographically reduced using in-house equipment. The substrates can then be manufactured using a number of technologies, including thick and thin film on aluminum and aluminum nitride or copper clad soft substrates. The units are then assembled in our MIC laboratory using several wire bonders, including a deep access thermosource wedge bonder. The finished product is then tested using either industry standard network analyzers and/or Lucas Weinschel measurement receivers.

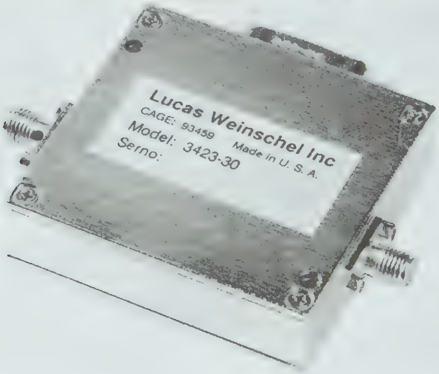
The Lucas Weinschel MIC group can produce prototype and limited production of high and low frequency microwave devices to specific customer requirements. Lucas Weinschel designs and creates all necessary master artworks to be used in the production of these devices. In-house capabilities include photo reduction, imaging, and the etching of our specially designed circuits. Lucas Weinschel can also provide customer defined packaging and testing requirements. Other capabilities include:

- Precision Artwork Generation and Precision photo lithography.
- Precision Etching (Hard and Soft Substrates).
- Thermocompression Bonding (Wire and Ribbon).
- Ultrasonic Thermocompression Bonding (Wire and Ribbon)
- Solid State Pin Attenuators, Switches and Phase Shifters, and other Custom Products.

Models 3421-30, 3422-30 & 3423-30

PIN DIODE ATTENUATORS 4 to 8 GHz

Phase Compensated



This series of Pin Diode Attenuators achieves minimum phase shift by using two separate attenuator sections. Each section is non-reflective at all attenuation levels since a balanced design is used. The phase shift is minimized by special matching networks. This design has considerably lower insertion loss compared to competing units due to its simple design. Its relatively small 2"x2"x.5" package also provides an answer where space is a problem. Variations from the specifications are offered for the unique requirements (Figure 1). Other features include:

* **Low Insertion Loss**

* **Minimum Phase Shift**

* **Relatively Small Package**

* **Solid State Reliability**

SPECIFICATIONS

FREQUENCY: 4 to 8 GHz

SWR: 1.75 maximum

INSERTION LOSS (MAX.)**:** 3 dB

ATTENUATION RANGE: 32 dB

IMPEDANCE (NOM.): 50 Ω

INPUT POWER: 100 mW CW (no damage for 1W CW, 100W peak

HARMONIC DISTORTION: 50 dBc for +10 dBm

OPERATING TEMPERATURE: 0 to 70° C

PHASE LINEARITY:

±10° over 0-20 dB attenuation
±15° over 20-30 dB attenuation

ATTENUATION FLATNESS: ± 1 dB over attenuation range

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions, mate nondestructively with connectors per MIL-C-39012. Lucas Weinschel offers two connector options for this Model, as follows:

-1 signifies SMA female (input and output)
-2 signifies SMA male (input) and SMA female (output)

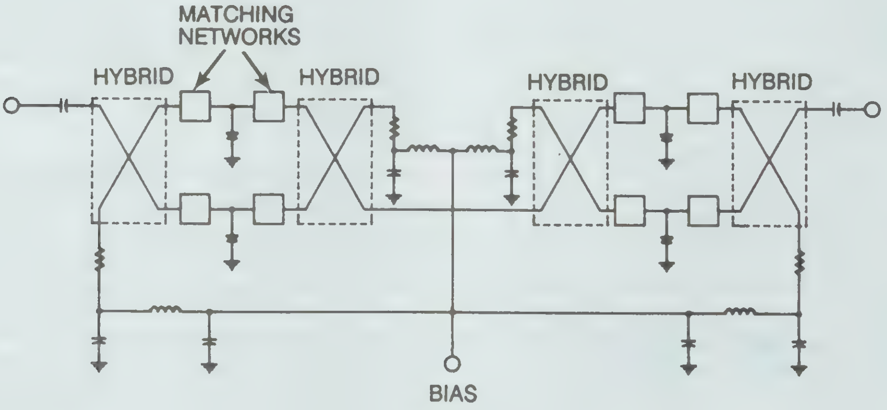


Figure 1. Functional Schematic Diagram

DRIVER OPTIONS:

NO Driver (Model 3421-30):

Rise Time: < 2 µSec (with suitable driver)
Fall Time: < 20 nsec

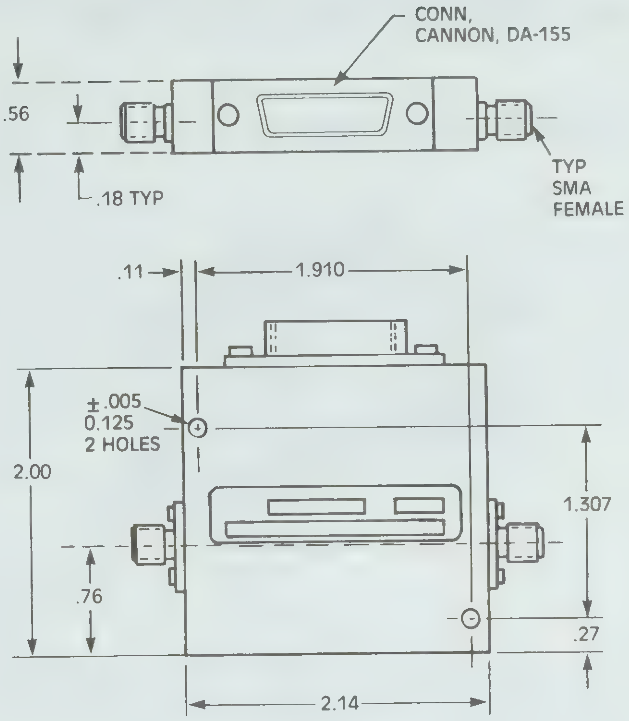
ANALOG Driver (Model 3422-30):

Operating Voltages: ± 15 V
Operating Current: +50 mA maximum
Attenuation Linearity: +1 dB
Rise Time: < 2 µsec
Fall time : < 20 nsec
Temperature Stability: ± 0.5 dB from +10 to +50 °C
0 to +6 V control range

DIGITAL Driver (Model 3423-30):

Operating Voltages: ± 15 V
Operating Current: ± 50 mA maximum
Attenuation Linearity: ± 1 dB
Rise and Fall Time: < 20 µSec
Temperature Stability: ± 0.5 dB from +10 to +50°C
Nominal Resolution: 0.125 dB (monotonic)

PHYSICAL DIMENSIONS:



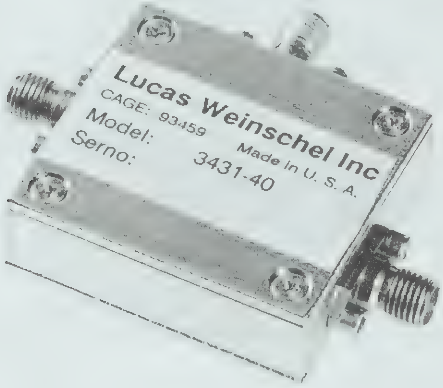
Note: ALL dimensions are in inches.

Model 3431-40

8 to 12.4 GHz

PIN DIODE MODULATOR

Low Video Leakage


Lucas Weinschel Inc
CAGE: 93459
Made in U. S. A.
Model: 3431-40
Serno:

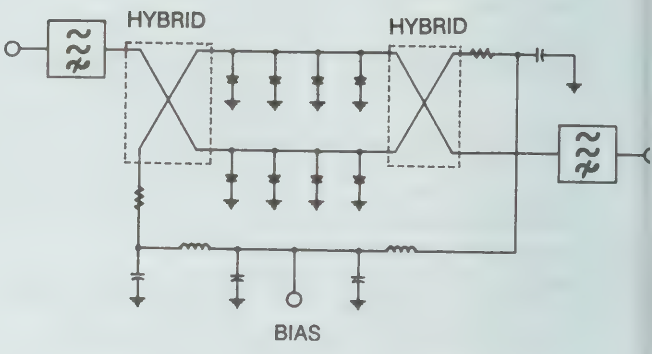

HYBRID
HYBRID
BIAS

Figure 1. Functional Schematic Diagram

Lucas Weinschel's new model is one in a series of PIN device releases. This series utilizes four diodes in each arm to achieve maximum isolation. Its exceptionally low video leakage along with its small package 1"x1.5"x.5" makes it a unique component in its field. This device can also be used in applications where a very large dynamic range attenuator is needed, since the balanced design is non-reflective at any attenuation value. As in our other PIN designs, we offer variations for the problem requirement (Figure 1). Other features include:

- **Low Insertion Loss**
- **Relatively Small Package**
- **Solid State Reliability**

SPECIFICATIONS

FREQUENCY RANGE: 8 to 12.4 GHz

MINIMUM INSERTION LOSS: ≤ 3.5 dB (at -5 V bias)

MAXIMUM INSERTION LOSS: > 90 dB (at 20 mA bias)

SWR: 2.0 maximum

MAXIMUM RF INPUT POWER: 100 mW

SWITCHING SPEED: (min-max/max-min): ≤ 20 nsec

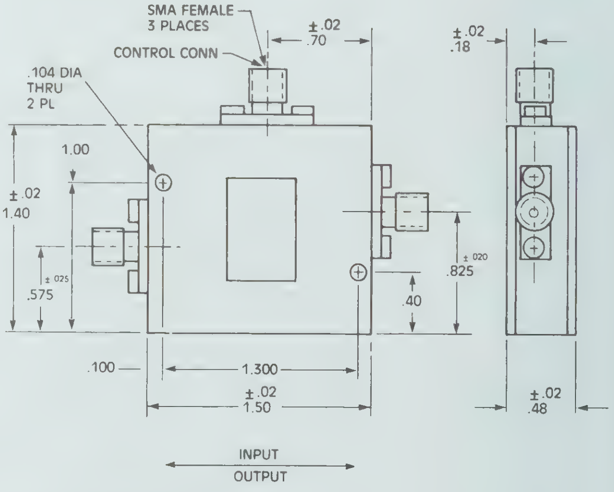
VIDEO LEAKAGE: < 20 mV

TEMPERATURE: 0 °C to 60° C operating
-40 °C to 70° C nonoperating

CONNECTORS: SMA connectors per MIL-STD-348 interface dimensions and mate nondestructively connectors per MIL-C-39012. Lucas Weinschel offers two connector options for this Model, as follows:

- -1 signifies SMA female (input and output)
- -2 signifies SMA male (input) and SMA female (output)

PHYSICAL DIMENSIONS:


SMA FEMALE
3 PLACES
CONTROL CONN
.104 DIA
THRU
2 PL
±.02
.70
±.02
.18
1.00
±.02
1.40
±.025
.575
±.020
.825
.40
.100
1.300
±.02
1.50
±.02
.48
INPUT
OUTPUT

Note: ALL dimensions are in inches.

Instruments & Measurement Accessories

GENERAL INFORMATION

Lucas Weinschel designs and manufactures a sophisticated line of state-of-the-art calibration and measurement equipment. These products provide automatic and semi-automatic measurements of attenuation, RF power, and frequency. Included in this product line are attenuation standards, RF power standards, RF power bridges, and signal sources. Many of these products are controllable over the IEEE-488 bus and ideal for use in automatic test equipment (ATE).

In this section of the catalog, each instrument and their accessories are outlined ultilizing individual data sheets containing product features, specifications, and outline drawings. These data sheets are preceded by a quick reference guide to help you quickly select the instrument or measurement accessories that fit your needs or requirements. The page number for each data sheet is given in the quick reference guide.

Instruments & Measurement Accessories Quick-Reference Guide

Model	Description	Page
8850	Attenuation Measurement System	128
VM-7	Attenuator and Signal Calibrator	130
8852	Frequency Converter 0.01-18 GHz)	132
8853	Frequency Converter (18-40 GHz)	134
VM-4B	Attenuator and Signal Generator Calibrator	136
1611	Frequency Extension (18-26.5 GHz)	150
1612	Frequency Extension (26.5-40 GHz)	141
1619	Frequency Extension (0.01-26.5 GHz)	142
VM-24	Attenuator and Signal Generator Calibrator	144
System IIA	Automatic Power Meter Calibration System	147
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Lucas Aerospace

Communications & Electronics

New Product

Model 8850
ATTENUATION MEASUREMENT SYSTEM

0.01 to 18 GHz

IEEE - 488

High Accuracy ± 0.005 dB/10 dB ± 0.010 dB

The Model 8850 Attenuation Measurement System combines the outstanding accuracy, performance, high sensitivity, and reliability of our Model VM-7 Attenuator and Signal Calibrator with our new Model **8852,** 0.01 to 18 GHz Frequency Converter.

When combined with a suitable generator the Model 8850 provides the user with an attenuation calibration system of high accuracy, repeatability and speed.

Some other features of this system include:

- **ADVANCED TECHNIQUES -** Advanced digital detection and processing techniques of the VM-7 means that measurements are available instantaneously, no matter what the dynamic range or resolution.
- **TWO BAND OPERATION** - The RF input frequency range is divided into two bands, 0.01 to 2 GHz, and 2 GHz to 18 GHz. This allows the user direct access to the RF port of either the LOW band or HIGH band mixer to make full use of the VM-7 dynamic range. In addition external masking attenuators and a power divider can be added to convert the unit to a 0.01 to 18 GHz single port converter, removing the speed and repeatability problems associated with microwave switches.
- **IEEE-488 BUS PROGRAMMABLE -** Remote programmability over the IEEE-488 bus using an external controller or controlling the system using only the VM-7.
- **AUXILIARY OUTPUT** - An auxiliary output of 2 to 18 GHz synthesized continuous wave signal in 2 KHz steps at +7 dBm is available, which can be used as an RF signal source for other applications.
- **VERSATILE AND USER FRIENDLY -** This measurement system will test all types of attenuators such as fixed, manual, motorized, programmable and other coaxial components. Using Lucas Weinschel test software can provide an efficient and user friendly way to test all types of coaxial components quickly and accurately.

OPTIONS

Option 01 - The 01 option includes a Lucas Weinschel RF Signal Generator and the necessary accessory kit (P/N 187-4001) of Lucas Weinschel low SWR masking attenuators and power divider to provide a measurement system as shown in Figure 1. The result is a measurement system that leads the field in performance, at a price compatible with production test as well as calibration laboratory budgets.

Option 02 - The 02 option includes all items in the 01 option and the addition of a PC compatible system controller and software package (P/N 189-7-8).

Model 8850 Attenuation Measurement System

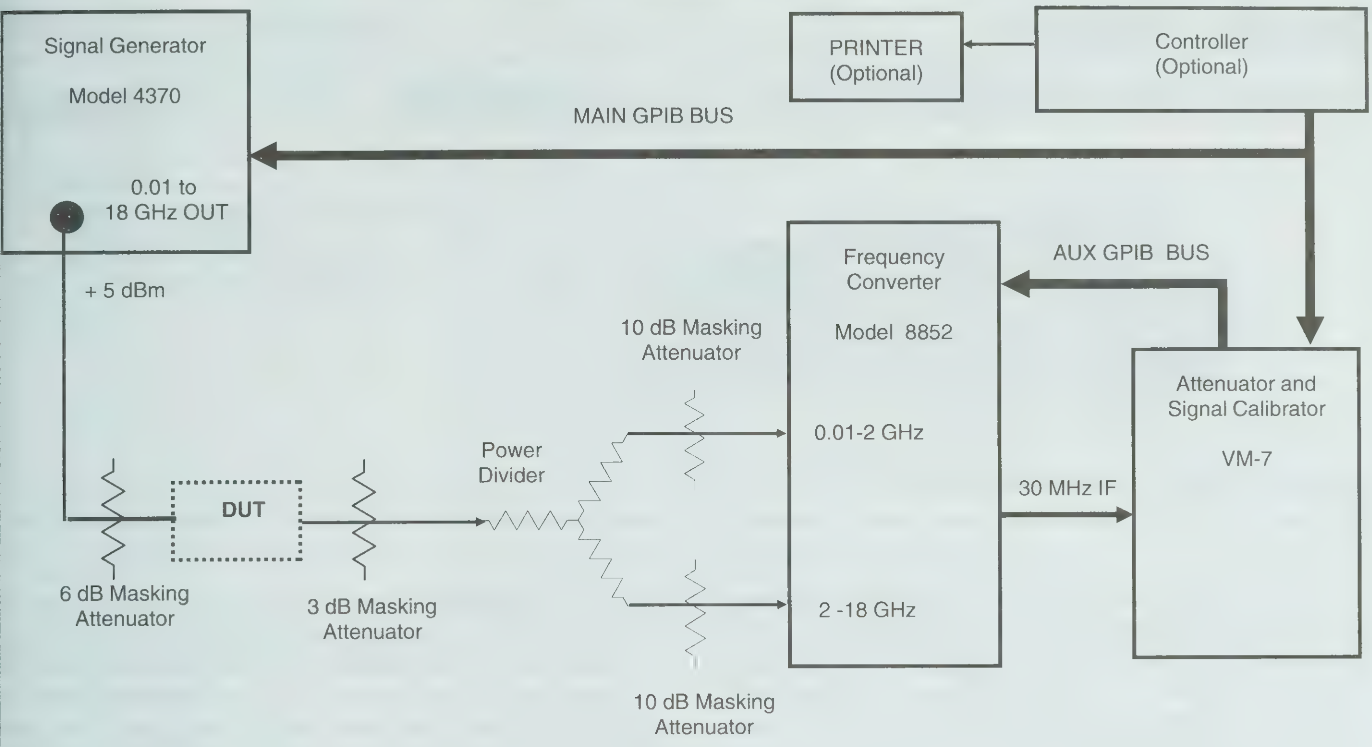

Signal Generator
Model 4370
0.01 to 18 GHz OUT
PRINTER (Optional)
Controller (Optional)
MAIN GPIB BUS
+ 5 dBm
Frequency Converter
Model 8852
AUX GPIB BUS
10 dB Masking Attenuator
Attenuator and Signal Calibrator
VM-7
0.01-2 GHz
Power Divider
30 MHz IF
DUT
6 dB Masking Attenuator
3 dB Masking Attenuator
2 -18 GHz
10 dB Masking Attenuator

Figure 1. Typical System Configuration

SPECIFICATIONS

FREQUENCY RANGE: 0.01 to 18 GHz

DYNAMIC RANGE:

0 to -103 dBm	10 to 300 MHz
0 to -112 dBm	300 to 1000 MHz
0 to -117 dBm	1000 MHz to 18 GHz

8850 ATTENUATION MEASUREMENT RECEIVER, LINEARITY ACCURACY [1]:

ACCURACY	RANGE (dBm)
± 0.100/10 dB	-10 to -20
± 0.005/10 dB	-20 to -100
± 0.100/10 dB	-100 to -117

8850-01/02 ATTENUATION MEASUREMENT SYSTEM, ATTENUATION ACCURACY [2]:

ACCURACY	RANGE (dB)
± 0.015 dB	(System Repeatability)
± 0.005/10 dB	0 to 80
± 0.100/10 dB	80 to 105

1. Exclusive of signal source, SWR effects and connector repeatability (1-18 GHz).
2. Exclusive of SWR effects and connector repeatability (1-18 GHz).

ORDERING GUIDE

Model #	System Configurations
8850	VM-7, 8852, and Accessory Kit
8850-01	VM-7, 8852, 4370 Source and Accessory Kit
8850-02	VM-7, 8852, 4370 Source, Computer and Accessory Kit

ACCESSORIES

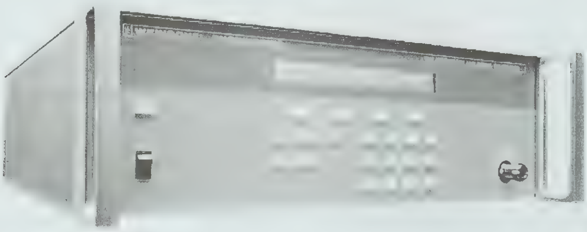
MB-4 Measurement Bench - The ultimate in alignment precision and mechanical stability is achieved with the addition of the Model MB-4 Measurement Bench. The unit features three adjustable scissor-jack supports and an adjustable clamping support for the secure mounting of the insertion point and power splitter.

Model 8300 Attenuator (Level Set) - The Model 8300 has the ability to store and hold calibration data. An enhanced user interface, and digital display allows the operator to dial in the frequency, nominal attenuation setting and then display the actual calibrated value of attenuation, not just individual attenuator cell values. The GPIB bus (IEEE-488) interface gives both read and write access to the calibration data array, allowing for computer automated calibration setups.

Model VM-7

ATTENUATOR AND SIGNAL CALIBRATOR 30 MHz

IEEE - 488



Advanced 30 MHz Receiver

The Lucas Weinschel Model VM-7 offers the user great flexibility in configuring a measuring system in a cost effective manner. Since the VM-7 is a 30 MHz receiver, it may be adapted easily to any frequency range with the addition of an appropriate external mixer, and local oscillator. Other features include:

ADVANCED TECHNIQUES: The Model VM-7 uses advanced digital and analog techniques in a series IF substitution configuration, offering in excess of 100 dB dynamic range, plus the unit is fully bus controllable.

A combination of switched gain and attenuation stages are distributed throughout the receiver. In place of the classic piston attenuator an A/D is used to provide the receiver's unique linearity and accuracy.

The unit is configured as a dual-conversion receiver. A digitally-controlled phase lock loop at the first conversion allows the receiver to deal effectively with less desirable signals, as well as clean, synthesized signals.

Final synchronous detection is handled digitally allowing the receiver to achieve resolution down to 0.001 dB. Variations in signal-to-noise ratio are not handled by injection of noise as in previous receivers of this type. This is now handled in the post detection signal processing using a noise algorithm.

RELIABILITY: The VM-7 has undergone extensive testing on production units so that customers will be ensured of excellent reliability in service. Special attention has been paid to cooling requirements, significantly extending component life.

USER FRIENDLY: Through the use of "soft key" user interface, the operator is guided through the use of the instrument. A "Help" function provides information on key operation, precluding the need to refer to the manual in most cases.

PERFORMANCE: The VM-7 offers dynamic range of 127 dB when using synthesized signal sources. Single step measurements are possible over the full dynamic range because the receiver is not encumbered by mechanically switched range changes. With the excellent accuracy built into the receiver, this translates into an accuracy of ± 0.060 dB for a single-step 100 dB measurement.

SPEED OF OPERATION: Advanced digital detection and processing techniques mean that measurements are available instantaneously, no matter what the dynamic range or resolution.

SELF CALIBRATION: A built-in self calibration routine allows for automatic calibration of the switched gain and attenuator stages in order to maintain the exceptional accuracy of the instrument.

DIAGNOSTICS & SERVICE: Complete diagnostic software has been built into the instrument to allow a technician to easily find a fault. Should repair become necessary, every module is easily removed through the rear panel, including the power supply.

RACK MOUNTING - This instrument can be stacked easily with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to MIL-STD-189 or EIA RS-310 using the appropriate rack mounting kit.

SYSTEM CONFIGURATION: The Model VM-7 is easily configured into an attenuation measuring system with the addition of the Model 8852 Frequency Converter and an RF signal source. This system is capable of performing attenuation measurements from 0.01 to 18 GHz. The Frequency range can be extended even further to 40 GHz with the addition of the Model 8853 Frequency Converter. For detailed specifications and a block diagram of such a system refer to the Model 8850 Attenuation Measurement System data sheet.

Model VM-7 Attenuator and Signal Calibrator

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

NOTE: Specifications subject to change without notice.

SPECIFICATION	DESCRIPTION
INPUT FREQUENCY	30 MHz ± 2 MHz
SENSITIVITY	-110 dBm wideband -127 dBm narrowband
DYNAMIC RANGE	110 dB wideband 127 dB narrowband
INCREMENTAL ACCURACY @ 30 MHz	RANGE (dBm) — ACCURACY (dB)* (Repeatability) — ± 0.005 dB 0 to -10 — ± 0.01 dB/10 dB -10 to -100 — ± 0.005 dB/10 dB -100 to -110 — ± 0.02 dB /10 dB -110 to -120 — ± 0.08 dB /10 dB * Exclusive of Signal Source effects
AUTOMATIC FREQ CONTROL	Output level, ± 10 V max
CALIBRATION SOURCE	Internal or External, 30 MHz, at -55 dBm typical
INT 10 MHz REF OSCILLATOR	Frequency Accuracy: 0.0025 %
EXT 10 MHz REF OSCILLATOR REQUIREMENTS	Frequency Accuracy: 0.0050 % (0 dB Input level)
INPUT CONNECTORS	30 MHz Input: Type N Female 10 MHz Reference Input/Output: BNC Female
REMOTE OPERATION	All front panel functions except powerline operation can be programmed on the IEEE 488-1978 interface bus.
INPUT POWER REQUIREMENTS	100, 120, 220, 240 Vac ± 10% @ 50 to 60 Hz
POWER CONSUMPTION	90 Watts
REMOTE PROGRAMMABILITY	Compatible with IEEE-488 STD-1987.1
EMI	Designed to meet MIL-STD-461 for radiated emission and susceptibility.
DESIGN AND CONSTRUCTION	Designed to meet requirements of MIL-STD-28800D TYPE III, CLASS 5, STYLE E
TEMPERATURE	Operating 0 to 50 ˚C Storage -40 to +75 ˚C
DIMENSIONS	Height: 133.4 mm (5.25 in) Width: 425.5 mm (16.75 in) Depth: 444.5 mm (17.5 in)
HUMIDITY	95 %
WEIGHT	Net 12.7 kg (28 lbs)

ACCESSORIES:

RACK MOUNTING - This instrument can be rack mounted in any cabinet or rack designed according to MIL-STD-189 or EIA RS-310 using rack mounting kit P/N 187-1007 (adapter ears only) or 187-1008 (contains chassis slides for racks up to 18-24 inches deep).

SPARE MODULE KIT, P/N 187-1030: This kit includes all replaceable module assemblies that can be easily replaced at any location.

GENERAL TEST SOFTWARE - Lucas Weinschel offers a General Test Program (P/N 189-7-8) to allow the user to perform automated attenuation and SWR measurements. The Software is menu driven and operates on an IBM PC or Compatible that contains a GPIB interface card and HT Basic software or HP 9000-200/300 Series Controller. Once the measurements have been performed the software will allow the user to display, graph and/or printout the measurement data taken. Contact Factory for more information.

Model 8852

FREQUENCY CONVERTER

0.01 to 18 GHz

IEEE - 488

PLANAR CROWN™ CONNECTOR SYSTEM

Extends Your VM-7 Capabilities to 18 GHz !!!

The Frequency Converter Model 8852 is a frequency conversion device that is intended for use with any Lucas Weinschel Inc Model VM-7 Attenuator and Signal Calibrator over the frequency band of .01 to 18 GHz. The 8852 extends the VM-7's capabilities to measure devices at frequencies other than 30 MHz. Other features include:

* **AUX OUTPUT** - This RF output supplies a 2 to 18 GHz synthesized continuous wave signal in 2 KHz steps at +7 dBm, which can be used as a signal source for other applications.
* **IEEE-488 BUS PROGRAMMABLE:** The Model 8852 operational parameters are controlled over the IEEE-488 compatible bus using an external controller or an upgraded VM-7 with applicable software.
* **10 MHz REF INPUT/OUTPUT** - This instrument will either accept or provide a 10 MHz reference signal for system operation.
* **RACK MOUNTING** - This instrument can be stacked easily with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to MIL-STD-189 or EIA RS-310 using the appropriate rack mounting kit.

PLANAR CROWN ™CONNECTOR SYSTEM: The use of Lucas Weinschel Planar Crown ™ connectors at the two INPUT connectors provides the Model 8852 user with easy exchange of connector types and eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick replacement of defective connectors. All crowns will mate nondestructively with connectors per MIL-STD-39012 (refer to PLANAR CROWN™ data sheet for more details).

SYSTEM OPERATION: The Model 8852 is easily configured into an attenuation measuring system with the addition of the Lucas Weinschel VM-7 and a signal source. This system is capable of performing attenuation measurements from 0.01 to 18 GHz. For detailed specifications and block diagrams of such a system refer to the Model 8850 Attenuation Measurement System data sheet. The Frequency range can be extended even further to 40 GHz with the addition of the Model 8853 Frequency Converter.

ACCESSORIES

UPGRADE KIT (VM-7/8852), P/N 187-1009: For those customers who own a VM-7 with only one bus connector on the I/O Card, Lucas Weinschel offers an upgrade Kit to allow your VM-7 to control the Model 8852 without a bus controller.

Model 8852
Frequency Converter

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

NOTE: Specifications subject to change without notice.

SPECIFICATION	DESCRIPTION
INPUT FREQUENCY RANGE	LOW BAND: 10 MHz to 2 GHz HIGH BAND: 2 GHz to 18 GHz
FREQUENCY RESOLUTION	1 kHz from .01 to 2 GHz 2 kHz above 2 GHz
MAXIMUM INPUT LEVEL	+20 dBm
NOMINAL IMPEDANCE	50 Ω
MIXER COMPRESSION	+1 dBm (1 dB compression)
SWR AT RF INPUT CONNECTOR	LOW BAND (0.01-2 GHz) 3.0 maximum HIGH BAND (2-18 GHz) 3.0 maximum
CONVERSION GAIN (RF IN to 30 MHz)	0 dB nominal from 0.01 to 18 GHz
NOISE FIGURE	12 dB maximum
OUTPUT FREQUENCY	30 ± 2 MHz
INTERNAL 10 MHz REFERENCE OSCILLATOR	Frequency Stability: ± 1 ppm @ 0 to 50 ˚C Output Level: + 10 dBm
EXTERNAL 10 MHz REFERENCE OSCILLATOR REQUIREMENTS	Input Impedance: 50 Ω Input Level: +5 dBm
AUX OUTPUT	2 to 18 GHz, +7 dBm ± 1.5 dB
OPERATION	IEEE-488 bus control or VM-7 Local mode (Note: Only if the VM-7 I/O card has been upgraded with two bus ports and applicable software)
REMOTE PROGRAMMABILITY	Compatible with IEEE-488 STD-1987.
CONNECTORS	RF INPUT: PLANAR CROWN™ (female Type N) 10 MHz EXT INPUT female BNC 10 MHz OUTPUT female BNC 30 MHz OUTPUT female Type-N AUX OUTPUT female SMA Digital Interface 24 pin per IEEE-488
INPUT POWER REQUIREMENTS	100, 120, 220, 240 Vac ± 10% @ 40 to 400 Hz
POWER CONSUMPTION	180 Watts
EMI	Designed to meet MIL-STD-461 for radiated emission and susceptibility.
DESIGN AND CONSTRUCTION	Designed to meet requirements of MIL-STD-28800D TYPE III, CLASS 5, STYLE E
TEMPERATURE	Operating: 0 to 50 ˚C Storage: -40 to +75 ˚C
HUMIDITY	95 %
DIMENSIONS	Height: 133.3 mm (5.21 in) Width: 426.7 mm (16.8 in) Depth: 619.8 (24.4 in)
WEIGHT	NET: 27.2 kg (65 lbs)

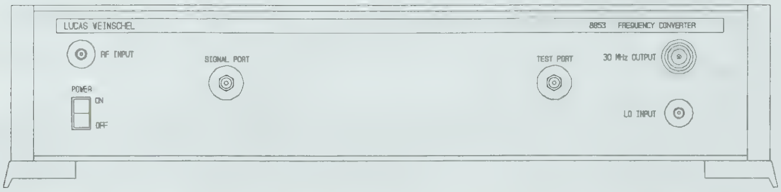
Lucas Aerospace
Communications & Electronics

New Product

Model 8853

FREQUENCY CONVERTER

18 to 40 GHz


LUCAS WEINSCHEL
8853 FREQUENCY CONVERTER
RF INPUT
SIGNAL PORT
TEST PORT
30 MHz OUTPUT
POWER
ON
OFF
LO INPUT

PLANAR CROWN™ CONNECTOR SYSTEM

Extends VM-7 Capabilities to 40 GHz in Coax !!!

The Model 8853 Frequency Converter is intended for use with any Lucas Weinschel Model VM-7 Attenuator/Signal Calibrator to create an 18 to 40 GHz measurement system. This Frequency Converter downconverts the 18 to 40 GHz measurement signal to a 30 MHz IF signal which can be measured by the VM-7. Using the Model 8853 with the Model 8852 Frequency Converter will allow the user to measure attenuation from 0.01 to 40 GHz without the use of an additional LO source. Figure 1 shows a typical Model 8853 Measurement System setup. Other features of the Model 8853 include:

- **Does NOT require a 40 GHz Signal Source.**
- **LOW TEST PORT SWR:** < 1.6
- **NO Additional Signal Sources Required** - When used with the Model 8850 Attenuation Measurement System the Model 8853 does not require any additional signal sources.
- **90 dB dynamic range with ± 0.04 dB/10 dB accuracy.**
- **Rack Mounting** - This instrument can be easily stacked with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack mounting kit.

PLANAR CROWN™CONNECTOR SYSTEM: The use of Lucas Weinschel PLANAR CROWN ™ connectors at the INPUT connectors provides the Model 8853 user with easy exchange of connector types and eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick replacement of defective connectors. All crowns will mate nondestructively with connectors per MIL-STD-39012 (refer to PLANAR CROWN™ data sheet for more details).

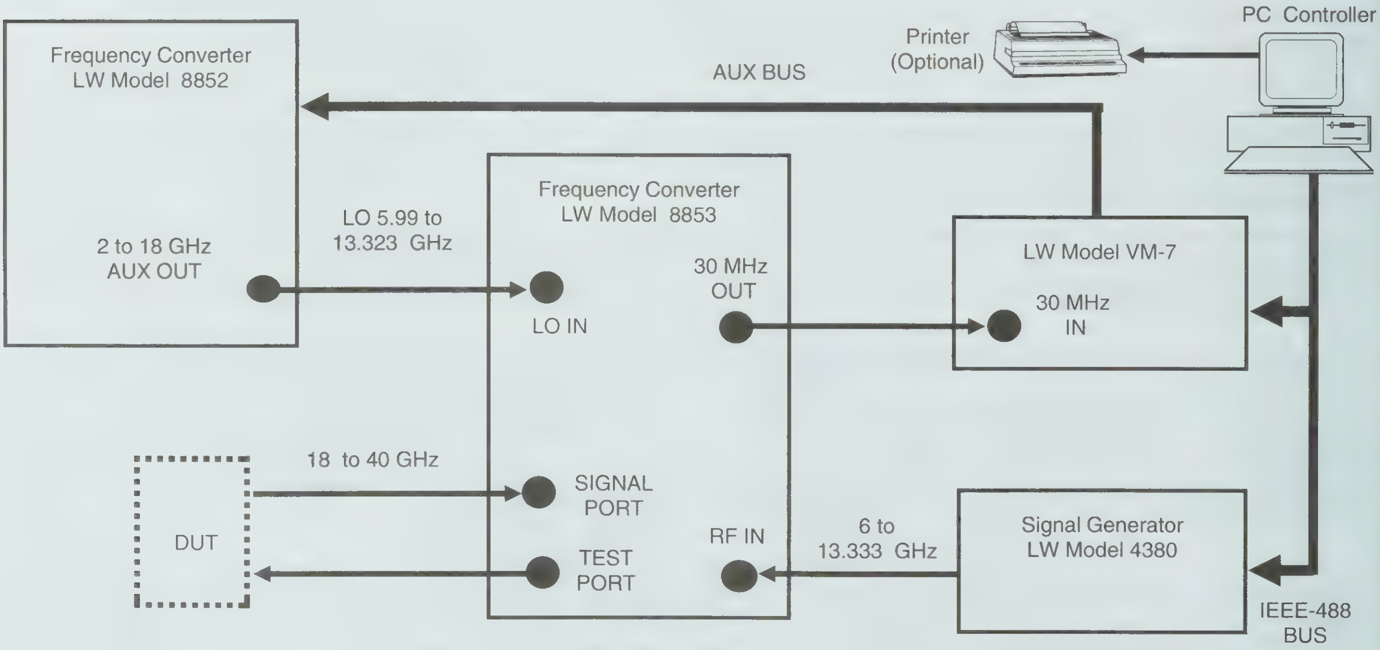

Frequency Converter
LW Model 8852
2 to 18 GHz
AUX OUT
AUX BUS
Printer
(Optional)
PC Controller
LO 5.99 to
13.323 GHz
Frequency Converter
LW Model 8853
LO IN
30 MHz
OUT
LW Model VM-7
30 MHz
IN
18 to 40 GHz
DUT
SIGNAL
PORT
TEST
PORT
RF IN
6 to
13.333 GHz
Signal Generator
LW Model 4380
IEEE-488
BUS

Figure 1. 8850/8853 (18-40 GHz) Measurement System

Model 8853
Frequency Converter

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

SPECIFICATION	DESCRIPTION	
FREQUENCY RANGE	SIGNAL PORT: RF IN: LO IN: IF OUT:	18 to 40 GHz 6 to 13.333 GHz 5.99 to 13.323 GHz 30 ± 2 MHz
RF SIGNAL LEVELS	RF INPUT: LO INPUT: SIGNAL PORT:	+5 dBm nominal/+10 dBm maximum +7 ± 2 dBm/+10 dBm maximum -2 dBm maximum/-10 minimum
NOMINAL IMPEDANCE	50 Ω	
INPUT LOAD SWR	<1.6	
CONNECTORS	RF INPUT: LO INPUT: 30 MHz OUTPUT TEST PORT: SIGNAL PORT:	SMA Female SMA Female Type-N Female PLANAR CROWN™2.92 mm Female PLANAR CROWN™2.92 mm Female
SUB-HARMONICS	-55 dBm	
WARM-UP PERIOD	3 hours minimum	
INPUT POWER REQUIREMENTS	100, 120, 220, 240 Vac ± 10% @ 40 to 400 Hz	
POWER CONSUMPTION	180 Watts	
DESIGN AND CONSTRUCTION	Designed to meet requirements of MIL-STD-28800D TYPE III, CLASS 5, STYLE E	
TEMPERATURE	Operating: Storage:	0 to 40 ˚C -40 to +75 ˚C
HUMIDITY	95 %	
DIMENSIONS	Height: Width: Depth:	88.9 mm (3.5 in) 425 mm (16.75 in) standard rack width 520.7 (20 in)
WEIGHT	NET: 10.66 kg (23.5 lbs)	

NOTE: Specifications subject to change without notice.

Lucas Aerospace

Communications & Electronics

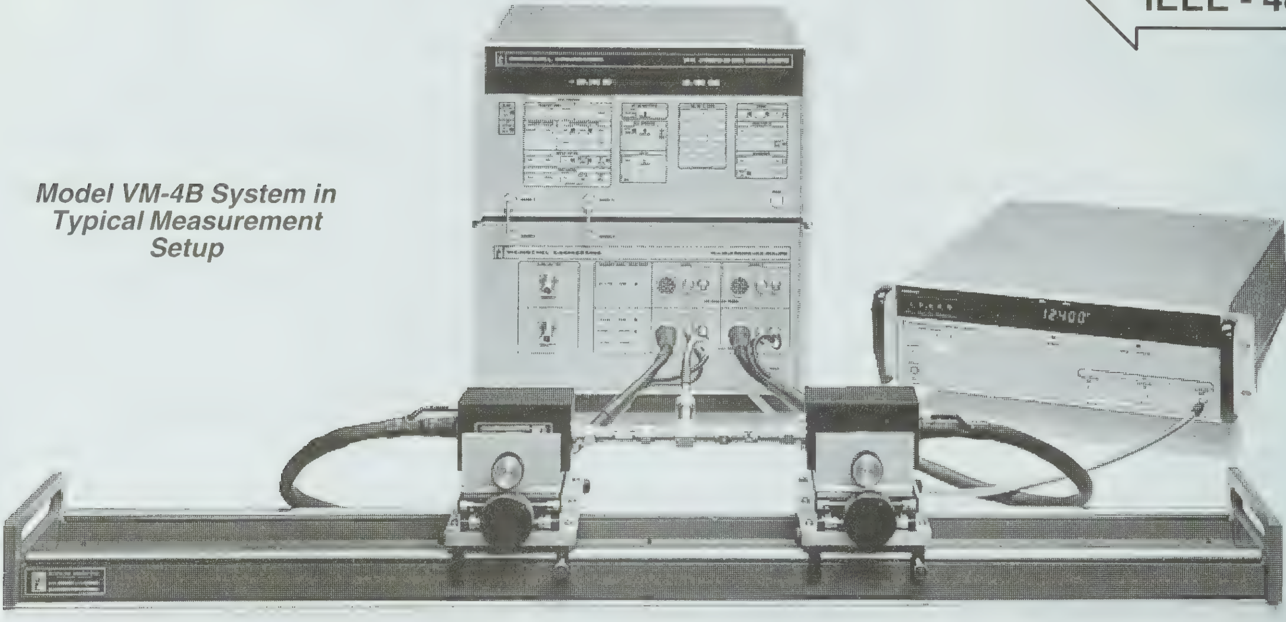
Model VM-4B
ATTENUATOR & SIGNAL GENERATOR CALIBRATOR

0.01 to 18.0 GHz

(Extendable to 40 GHz)

IEEE - 488

Model VM-4B System in Typical Measurement Setup



Rapid, Multifrequency, Precision Measurements

The Lucas Weinschel VM-4B is designed to perform fast, precision, automated measurements of insertion loss, gain, and phase. The VM-4B is the accepted standard for attenuation accuracy in use worldwide. Taking advantage of advanced technologies, the VM-4B features a digital system and resident software that makes its operation more versatile while improving measurement time and repeatability. The VM-4B performs measurements in the 0.01 to 18.0 GHz frequency range with a dynamic range in excess of 100 dB. This allows single-step measurements of large value attenuators to a resolution of 0.001 dB. A Phase Meter option allows the user to perform phase shift measurements over the entire frequency and dynamic range of the system, to a resolution of 0.01° (Figure 1). Other VM-4B System features include:

- **Fast Operation** - The VM-4B . . . *fast and accurate* measurements of transmission loss, gain and phase is a good choice to reduce measurement time on the production line, at the calibration and repair center, in the R&D laboratory, or any place where accuracy and time count.
- **Dual Channel or Single Channel Operation**.
- **Compatible -** Is compatible with many different types of RF Sources and IEEE-488 bus controllers.
- **Self-Test** - The VM-4B has a built in self test capability for the Microprocessor subsystem, the phase lock loop, and the measurement circuitry. The microprocessor self-check allows the user or operator to locate faults in the display, LEDs, keyboard, and command/bus. The 30 MHz self-test exercises the VM-4B System's ability to phase lock to a known signal, and to measure a known attenuation step.
- **Easy Operation** - The Model VM-4B operational paramaters can be either contolled over the IEEE-488 compatible bus using an external controller or using the VM-4B front panel touch controls.
- **Rack Mounting** - This instrument can be stacked on any bench with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack mounting kit.

Model VM-4B Attenuator & Signal Generator Calibrator

Lucas Aerospace
Communications & Electronics

SYSTEM CHARACTERISTICS

SPECIFICATION	DESCRIPTION
INPUT FREQUENCY	0.01 to 18.0 GHz (Standard unit) expandable to 26.5 using LW Model 1611 or 1619 and to 40 GHz using Model 1612
DYNAMIC RANGE	Greater than 100 dB
MEASUREMENT ACCURACY	± 0.02 dB/10 dB (Does not include signal source effects, mismatch errors and connector repeatability)
MEASUREMENT RESOLUTION	0.1, 0.01, and 0.001 dB
PHASE MEASUREMENTS (DUAL CHANNEL) Note: Option is field installable.	Range: ± 180 ° Resolution: 1°, 0.1°, and 0.01° Accuracy: ± 2.5 ° (Does not include mismatch errors and connector repeatability)
SYSTEM REPEATABILITY (after 3 hour warm-up; over a 20 minute period and temp variation of ± 1°C)	Insertion Loss: ± 0.015 dB maximum ± 0.008 dB typical Phase: ± 0.5 ° maximum ± 0.25 ° typical
SWR	Load: 1.27 at 18.0 GHz (1.15 typical)* Source: 1.15 at 18.0 GHz (less than 1.10 typical) * with masking attenuator
OPERATING MODES	Local: Front panel control Remote: All front panel functions except powerline operation can be programmed on the IEEE-488-1975 interface bus
MEASUREMENT PARAMETERS	Loss, Gain, Phase (Option 01)

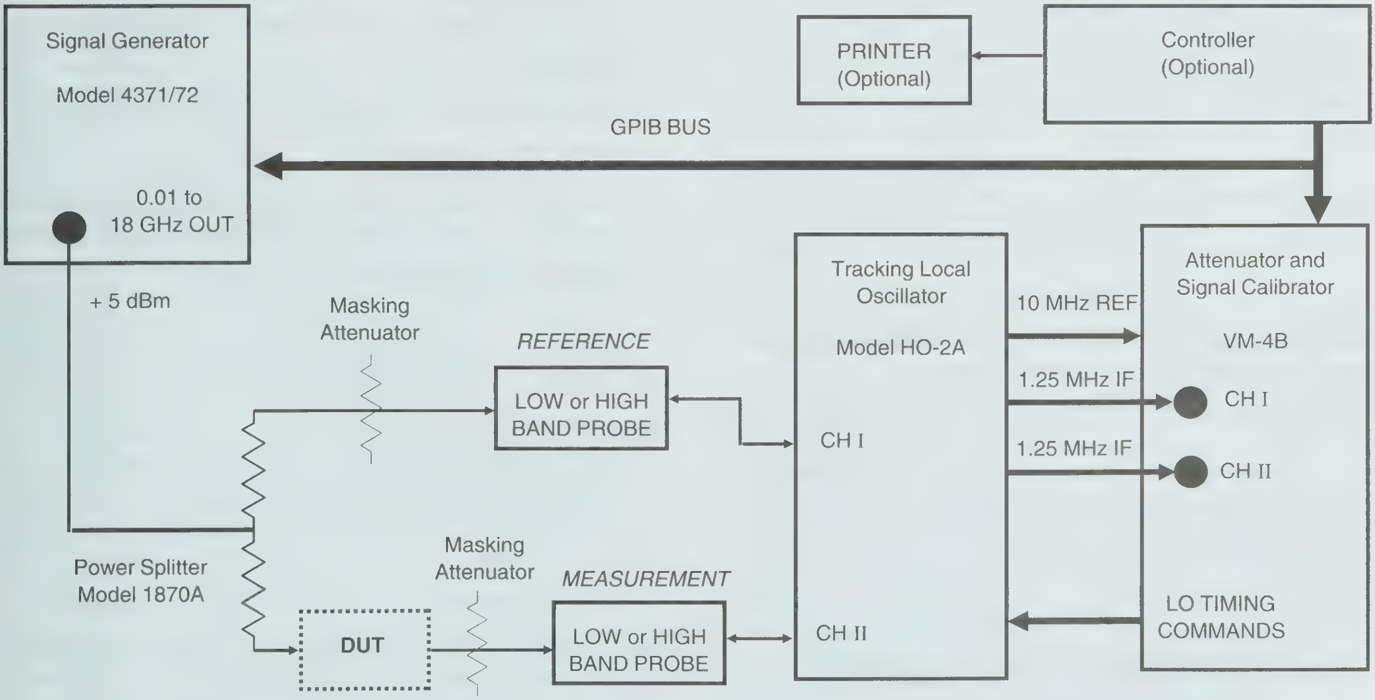

Signal Generator
Model 4371/72
0.01 to
18 GHz OUT
PRINTER
(Optional)
Controller
(Optional)
GPIB BUS
+ 5 dBm
Masking
Attenuator
REFERENCE
LOW or HIGH
BAND PROBE
Tracking Local
Oscillator
Model HO-2A
CH I
10 MHz REF
1.25 MHz IF
1.25 MHz IF
Attenuator and
Signal Calibrator
VM-4B
CH I
CH II
Power Splitter
Model 1870A
Masking
Attenuator
MEASUREMENT
DUT
LOW or HIGH
BAND PROBE
CH II
LO TIMING
COMMANDS

Figure 1. Typical System Configuration

VM-4B SPECIFICATIONS

FREQUENCY RANGE: 0.01 to 18.0 GHz

Low Band: 0.01 to 2.1 GHz (Nominal)
High Band: 2.0 to 18.0 GHz (Nominal)

INPUT SIGNAL LEVELS:

Nominal: -30 dBm (High Band)
-20 dBm (Low Band)
Maximum: 0 dBm

INPUT LOAD SWR (Maximum SWR with 44-30, 30 dB or 44-20, 20 dB Masking Attenuator):

FREQUENCY (GHz)	SWR
dc - 2	< 1.16
2 -4	< 1.17
4 - 12.4	< 1.22
12.4 - 18	< 1.27

SOURCE SWR (with Model 1870A Power Splitter):

FREQUENCY (GHz)	SWR
dc - 2	< 1.05
2 -4	< 1.07
4 - 12.4	< 1.10
12.4 - 18	< 1.15

CHANNEL ISOLATION (at probe input): 130 dB

DYNAMIC RANGE (Ref from 0 dBm):

OPERATION	FREQUENCY RANGE (GHz)		
	0.01 - 9	9 - 17.5	17.5 - 18
Single Channel	90 dB	85 dB	80 dB
Dual Channel	140 dB	130 dB	130 dB

DYNAMIC RANGE (Ref from -30 dBm) (Maximum error of 0.01 dB due to compression):

OPERATION	FREQUENCY RANGE (GHz)		
	0.01 - 9	9 - 17.5	17.5 - 18
Single Channel	60 dB	55 dB	50 dB
Dual Channel	100 dB	100 dB	100 dB

COMMON MODE REJECTION (dual channel):

± 0.01 dB/50 dB

LOCAL OSCILLATORS: Tracking PLL

PLL REFERENCE: 10 MHz xtal stabilized source

SEARCH RANGE (Operator Selected): ±2% to ± 15%

SYSTEM IF: 1.25 MHz

READOUT DISPLAY: 40-character alphanumeric

HARD COPY READOUT: RS 232 interface (local program mode)

WARM-UP PERIOD: 3 hours @ +25 ± 5 °C, ambient

RESOLUTION: 0.001 dB, 0.01 dB, 0.1 dB, front panel selectable

SELF-TEST FREQUENCY: 30 MHz

REMOTE CONTROL: Configured for IEEE Std-488-1975 GPIB bus controlled by suitable calculator or computer such as HP-85, Series 200 or any PC compatible system controller.

LOCAL PROGRAMMED OPERATION:

Number of frequency steps: 256 maximum
Number of RF bands: 3
Upper and lower limits in dB: 1 set per band
Resolution: 1 per band
Frequency spacing: Linear or Logarithmic (1 MHz minimum)

PHASE MEASUREMENTS (only if Phase Meter Kit P/N 190-497 is installed):

RESOLUTION: 0.01, 0.1, 1, consistent with selected attenuation measurement resolution

RANGE: -180 to +180

OPERATING TEMPERATURE: +10 °C to +40 °C

POWER REQUIREMENTS:

VM-4B: 115/230 Vac ± 10%, 48 to 400 Hz, 225 VA
HO-2A: 115/230 Vac ± 10%, 48 to 400 Hz, 125 VA

PHYSICAL DIMENSIONS (Each Unit):

Height: 216. mm (8.5 in)
Width: 425.5 mm (16.75 in)
Depth: 521 mm (20.5 in)

WEIGHT:

Model VM-4B: 21.6 kg (48 lbs)
Model HO-2A: 20 kg (45 lbs)

NOTE: Specifications subject to change without notice.

ACCESSORIES & ORDERING GUIDE

EXTENDABLE FREQUENCY RANGE: The upper frequency range of the VM-4B system can be extended with the addition of the following the units (refer to applicable data sheet for details of each Frequency Extension listed below):

Model 1611:	18 to 26 GHz Frequency Extension
Model 1612:	26.5 to 40 GHz Frequency Extension
Model 1619:	0.01 to 26.5 GHz Frequency Extension (continuous operation)

SIGNAL SOURCE COMPATIBILITY: The basic VM-4B software is compatible with the Lucas Weinschel 4370 Series Signal Sources (Models 4371 and 4372 recommended, refer to 4370 data sheet). Compatibility can be extended to include several signal sources from Hewlett Packard and EIP by replacing the standard EPROM with one of the optional units. Replacing an EPROM is a simple operation and is easily handled in the field. Select from the list below appropriate EPROM for your application:

MODEL#	NOMENCLATURE
190-1026-1	Optional EPROM for EIP 931/575 and 928/575 Systems
190-1026-2	Optional EPROM for HP 8672A
190-1026-4	Optional EPROM for HP 8340 and 8341

NOTE: All EPROMS are compatible with Lucas Weinschel 4370 Series Signal Sources. Contact Lucas Weinschel for more information about compatibility with other types of sources not listed.

PHASE MEASUREMENT OPTION: The VM-4A or VM-4B is capable of performing phase measurements by installing Phase Meter Kit (P/N 190-497). This option allows the user to perform phase shift measurements over the entire frequency and dynamic range of the VM-4 system, to a resolution of 0.01°. The Phase Meter KIt can be installed at Lucas Weinschel upon request or is easily field installable.

SPARE MODULE KITS: Lucas Weinschel offers spare module kits for both the VM-4B and HO-2 units. Each kit includes all replaceable module assemblies that can be easily replaced at any location. Order as follows:

190-1029	Spare Module Kit for VM-4B
190-1033	Spare Module Kit for HO-2A Unit

MAINTENANCE ACCESSORY KIT FOR VM-4B (P/N 190-1025): This kit includes three extender cards and interface cables to aid the user in testing, calibrating, adjusting and/or fault isolation of the VM-4B and HO-2 units.

TYPE N MEASUREMENT ACCESSORY KIT (P/N 190-532): This measurement accessory kit includes:

MODEL#	NOMENCLATURE
44-10	Fixed Attenuator (Type N)
44-20	Fixed Attenuator (Type N)
44-30	Fixed Attenuator (Type N)
44-60	Fixed Attenuator (Type N)
1870A	Resistive Power Splitter (Type N)
080-388	Torque Wrench

GPC 7 MEASUREMENT ACCESSORY KIT (P/N 190-533): This measurement accessory kit Includes:

MODEL#	NOMENCLATURE
44-10	Fixed Attenuator (Type N)
1595-20	Fixed Attenuator (Type N-GPC 7))
1595-30	Fixed Attenuator (Type N-GPC 7))
1595-60	Fixed Attenuator (Type N-GPC 7))
1872A	Resistive Power Splitter (GPC 7)
080-388	Torque Wrench

RACK MOUNTING: The VM-4A or VM-4B can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 190-499) or Rack Mount Adapters and Side Panels for Chassis Slides (P/N 190-500).

MEASUREMENT BENCH (MB-4): The ultimate in alignment precision and mechanical stability is achieved with the addition of the Model MB-4 Measurement Bench. Designed for complete compatibility with the full spectrum of VM-4B activity, the unit features three adjustable scissor-jack supports and an adjustable clamping support for the secure mounting of the insertion point and power splitter (refer to MB-4 data sheet).

AVAILABLE TEST SOFTWARE: *

Controller	Software	LWI Part No.
HP Series 200 /300	3-1/2" disc 5-1/4" disc	189-1-4 189-1-5
HP 85	tape	189-1-1
HP 86	3-1/2" disc	189-1-1

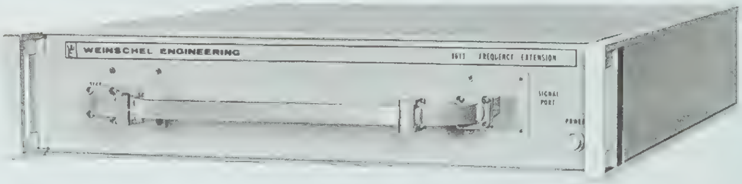
AVAILABLE APPICATION SOFTWARE: *

Controller	Software	LWI Part No.
HP 85	tape	189-2-1
HP 86	3-1/2 disc	189-2-2

* Contact factory for details.

Model 1611
FREQUENCY EXTENSION

18 to 26.5 GHz
(For Model VM-4)


WEINSCHEL ENGINEERING
1611 FREQUENCY EXTENSION
SIGNAL PORT
POWER

Waveguide, WR-42

The Model 1611 Frequency Extension Unit is intended for use with the Lucas Weinschel Model VM-4 Attenuator and Signal Generator Calibrator to down convert an 18 - 26.5 GHz "measure signal" to the 1 GHz IF signal which is then applied to the VM-4 via the low frequency probes. (If the VM-4 has the 01 phase option, more complex transmission measurements may be made.)

This Frequency Extension has been designed to ensure good channel-to-channel isolation with proper isolation and shielding. The result is a wide dynamic range measurement system for measuring precision waveguide devices such as rotary vane and "gauge block" step attenuators. Transitions to SMA compatible connectors permit measurements to be made on coaxial devices in that frequency range. Other features include:

- **70 dB dynamic range with ± 0.03/10 dB accuracy.**
- **Low Test Port SWR:** < 1.25
- **Rack Mounting** - This instrument can be stacked on any bench with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack mounting kit.

SPECIFICATIONS

FREQUENCY RANGE:	RF IN:	18 - 26.5 GHz
	LO IN:	8.5 - 12.75 GHz
	IF OUT:	1.0 GHz

RF POWER LEVELS:

RF IN:	0 dBm minimum, +5 dBm maximum
LO IN:	+10 dBm nominal
TEST PORT:	~-2 dBm

SYSTEM PERFORMANCE: (after 3 hour warm up)

Dynamic Range:	70 dB
Accuracy:	± 0.03 dB/10 dB*
Test Port SWR:	< 1.25

* Does not include mismatch error and connector repeatability.

CONNECTORS: Female SMA (RF IN and LO IN) and Type N (IF OUT) per MIL-STD-348 interface dimensions mates nondestructively with MIL-C-39012 connectors. Test Ports are WR42, waveguide.

POWER REQUIREMENTS:

100, 120, 220, 240 Vac ± 10%: 40 to 400 Hz

DIMENSIONS:

Height:	88.9 mm (3.5 in) with feet installed 102.4 mm (4.03 in)
Width:	425 mm (16.75 in) standard rack width
Depth:	457.2 mm (18 in)

ACCESSORIES PROVIDED:

LWI 1596-1 waveguide to coax adapters (2)
90° WR42 waveguide bends (2)
Semi-Rigid Cable Assembly (1)
WR42 straight section (1)

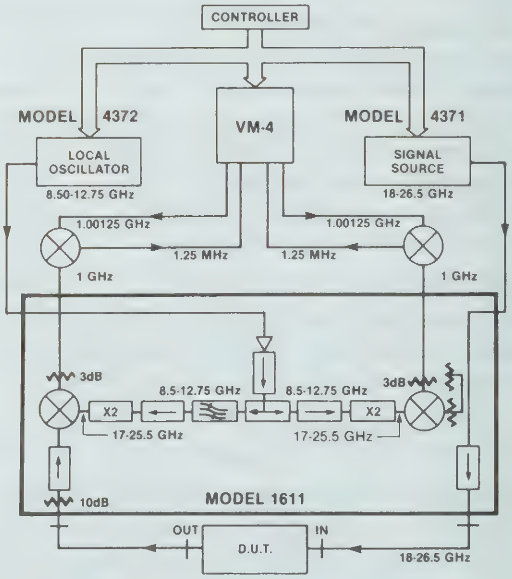
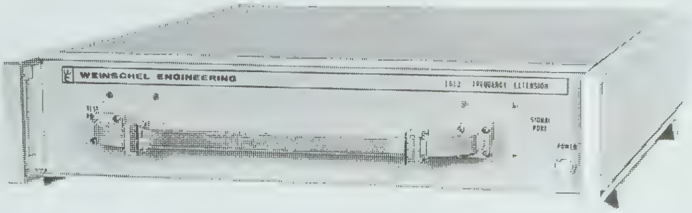

CONTROLLER
MODEL 4372
VM-4
MODEL 4371
LOCAL OSCILLATOR
8.50-12.75 GHz
SIGNAL SOURCE
18-26.5 GHz
1.00125 GHz
1.00125 GHz
1.25 MHz
1.25 MHz
1 GHz
1 GHz
3dB
8.5-12.75 GHz
8.5-12.75 GHz
3dB
X2
X2
17-25.5 GHz
17-25.5 GHz
10dB
MODEL 1611
OUT
IN
D.U.T.
18-26.5 GHz

Figure 1. Typical Model 1611 Configuration

Model 1612
FREQUENCY EXTENSION

26.5 to 40.0 GHz
(For Model VM-4)


WEINSCHEL ENGINEERING
1612 FREQUENCY EXTENSION
SIGNAL PORT
POWER

Waveguide, WR-28

The Model 1612 Frequency Extension Unit is intended for use with the Lucas Weinschel Model VM-4 Attenuator and Signal Generator Calibrator to down convert an 26.5-40 GHz "measure signal" to the 1 GHz IF signal which is then applied to the VM-4 via the low frequency probes. (If the VM-4 has the 01 phase option, more complex transmission measurements may be made.)

This Frequency Extension has been designed to ensure good channel-to-channel isolation with proper isolation and shielding. The result is a wide dynamic range measurement system for measuring precision waveguide devices such as rotary vane and "gauge block" step attenuators. Other features include:

* **70 dB dynamic range with ± 0.03/10 dB accuracy.**

* **Low Test Port SWR:** < 1.25

* **No additional sources needed for 26.5 to 40 GHz when used with Model 1611 or 1619.**

* **Rack Mounting** - This instrument can be stacked on any bench with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack mounting kit.

SPECIFICATIONS

FREQUENCY RANGE: RF IN: 8.83 - 13.33 GHz
LO IN: 12.75 - 19.5 GHz
IF OUT: 1.0 GHz

RF POWER LEVELS:

RF IN: ~0 dBm minimum, +5 dBm maximum
LO IN: 0 dBm mimimum
TEST PORT: ~-2 dBm

SYSTEM PERFORMANCE: (after 3 hour warm up)

Dynamic Range: 70 dB
Accuracy: ± 0.03 dB/10 dB*
Test Port SWR: <1.25

* Does not include mismatch error and connector repeatability.

CONNECTORS: Female SMA (RF IN and LO IN) and Type N (IF OUT) per MIL-STD-348 interface dimensions mates nondestructively with MIL-C-39012 connectors. Test Ports are WR28, waveguide.

POWER REQUIREMENTS:

100, 120, 220, 240 Vac ± 10 %: 40 to 400 Hz

PHYSICAL DIMENSIONS:

Height: 88.9 mm (3.5 in) with feet installed
102.4 mm (4.03 in)
Width: 425 mm (16.75 in) standard rack width
Depth: 457.2 mm (18 in)

ACCESSORIES PROVIDED:

90° WR28 waveguide bends (2)
90° WR28 waveguide twists (2)
WR28 straight section (1)

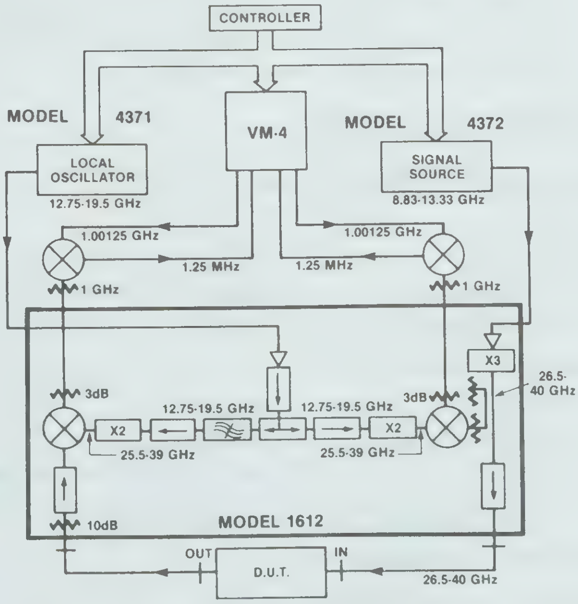
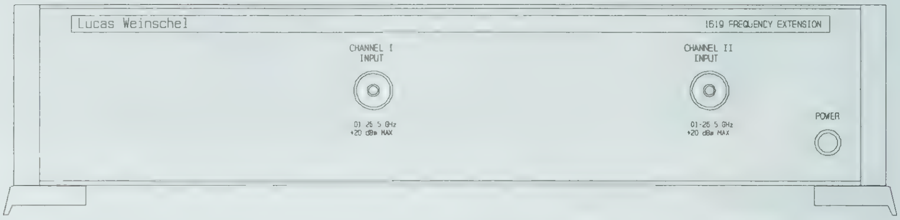

CONTROLLER
MODEL 4371
VM-4
MODEL 4372
LOCAL OSCILLATOR
SIGNAL SOURCE
12.75-19.5 GHz
8.83-13.33 GHz
1.00125 GHz
1.00125 GHz
1.25 MHz
1.25 MHz
1 GHz
1 GHz
X3
26.5-40 GHz
3dB
12.75-19.5 GHz
12.75-19.5 GHz
3dB
X2
X2
25.5-39 GHz
25.5-39 GHz
10dB
MODEL 1612
OUT
D.U.T.
IN
26.5-40 GHz

Figure 1. Typical Model 1612 Configuration

Model 1619
FREQUENCY EXTENSION

0.01 to 26.5 GHz
(For Model VM-4)



Extends VM-4 Capabilities to 26.5 GHz in Coax!!!

The Model 1619 Frequency Extension is intended for use with the Lucas Weinschel Model VM-4 Attenuator and Signal Generator Calibrator to provide a continuous operating frequency range of 0.01 to 26.5 GHz. The extension of the VM-4 frequency range is accomplished by down converting the measurement signal to within the norminal operating range of the VM-4. Figure 1 shows a typical VM-4 measurement setup using the Model 1619. Other features of the Model 1619 include:

- **Continuous Operation from 0.01 to 26.5 GHz.**
- **Eliminates probe changing when measuring between High and Low Band or above 18 GHz.**
- **Rack Mounting** - This instrument can be stacked on any bench with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack mounting kit.

SPECIFICATIONS

FREQUENCY RANGE (both channels):

RF Input(s):	0.01 To 26.5 GHz
LO Input(s):	9 to 13.25 GHz
Low Frequency Probe Output(s):	0.01 to 2 GHz
High Frequency Probe Output(s):	2 to 18 GHz

MAXIMUM INPUT LEVEL:

RF INPUT	+20 dBm maximum
RF INPUT	+20 dBm maximum
LO INPUT	+8 dBm nominal, +15 dBm maximum

DYNAMIC RANGE (-30 dBm Ref): 90 dB

INPUT LOAD SWR: < 1.8

CHANNEL ISOLATION: > 90 dB

LINEARITY * :

0 to 70 dB:	0.01 to 8 GHz	± 0.02 dB/10 dB
	8 to 26.5 GHz	± 0.03 dB/10 dB
70-80 dB:	0.01 to 8 GHz	± 0.05 dB/10 dB
	8 t0 26.5 GHz	± 0.08 dB/10 dB
80-90 dB:	0.01 to 8 GHz	± 0.10 dB/10 dB
	8 to 26.5 GHz	± 0.12 dB/10 dB

* Excluding signal source effects, mismatch errors, and connector repeatability.

INSTRUMENT CONVERSION LOSS:

0.01 to 2 GHz	22 dB (nominal)
2 to 18 GHz	22 dB (nominal)
18 to 26.5 GHz	34 dB (nominal)

WARM-UP PERIOD: 3 Hours (minimum)

CONNECTORS: All connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. Connectors are as follows:

RF Input(s):	PLANAR CROWN™ or SMA Female
LO Input(s):	SMA Female
Low Frequency Probe Output(s):	Type N Female
High Frequency Probe Output(s):	Type N Female

TEMPERATURE RANGE:

Operating : +10 to +40° C (+25 to 104° F)
Storage : -40° to +75° C (-67° to +167° F)

POWER REQUIREMENTS:

100, 120, 220, 240 Vac ± 10%: 40 to 400 Hz

WEIGHT: Net: 10.66 kilograms (23.5 lb)

PHYSICAL DIMENSIONS:

Height:	88.9 mm (3.5 in) with feet installed 102.4 mm (4.03 in)
Width:	425 mm (16.75 in) standard rack width
Depth:	520.7 mm (20 in)

Model 1619
Frequency Extension

SYSTEM CHARACTERISTICS

LONG-TERM REPEATABILITY (20 minutes):

± 0.025 dB (typical)

SHORT-TERM REPEATABILITY (between consecutive measurements): ± 0.015 dB (typical)

PHASE STABILITY: ± 0.5 °

ORDERING GUIDE

Model 1619-1: Only contains one channel for those applications where dual channel or phase measurements are not required.

Model 1619-2: A two channel instrument that allows the VM-4 to use both channels and even to perform phase measurements up to 26.5 GHz.

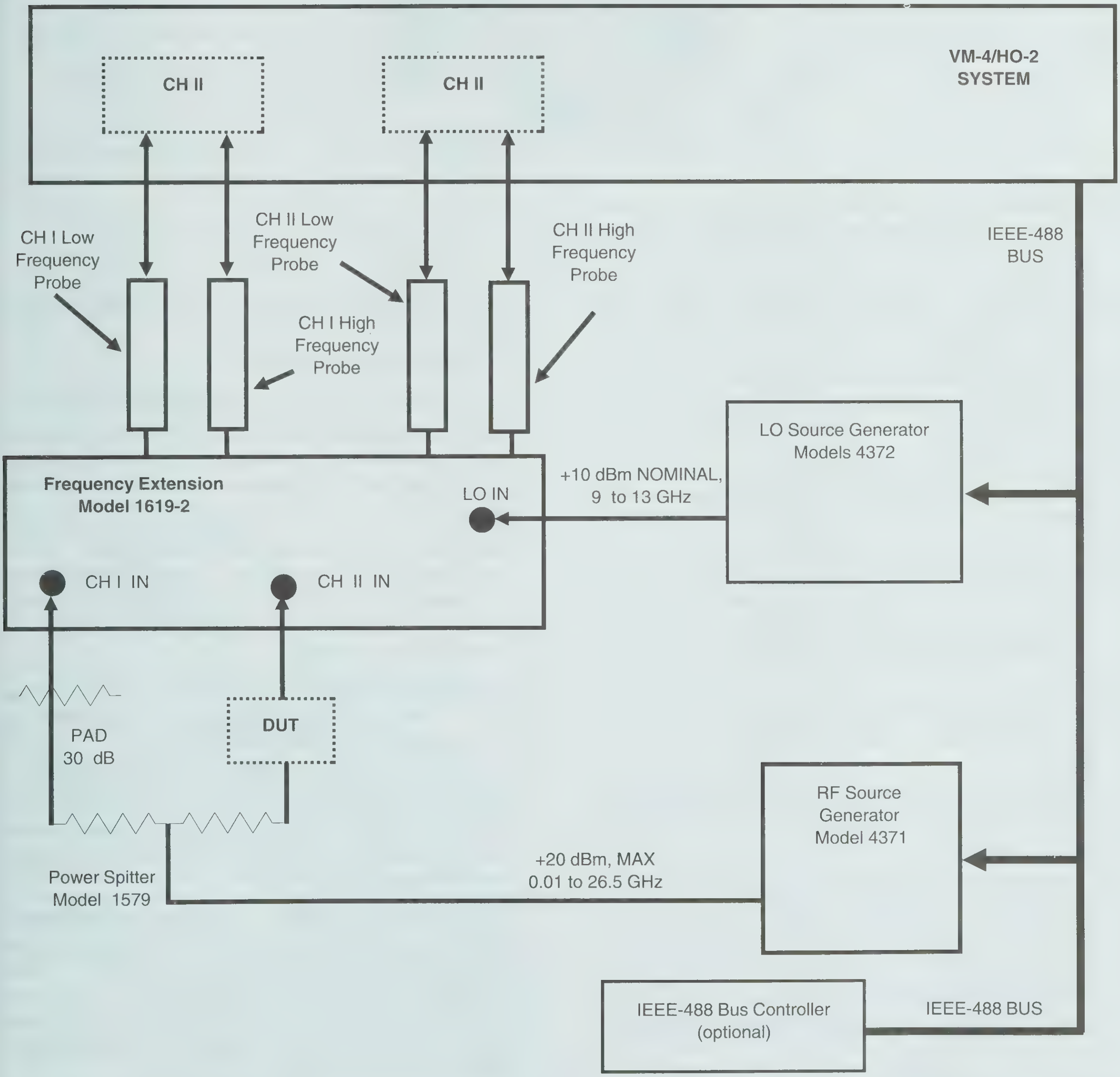

CH II
CH II
VM-4/HO-2 SYSTEM
CH I Low Frequency Probe
CH II Low Frequency Probe
CH II High Frequency Probe
CH I High Frequency Probe
IEEE-488 BUS
Frequency Extension Model 1619-2
LO IN
+10 dBm NOMINAL, 9 to 13 GHz
LO Source Generator Models 4372
CH I IN
CH II IN
PAD 30 dB
DUT
RF Source Generator Model 4371
+20 dBm, MAX 0.01 to 26.5 GHz
Power Spitter Model 1579
IEEE-488 Bus Controller (optional)
IEEE-488 BUS

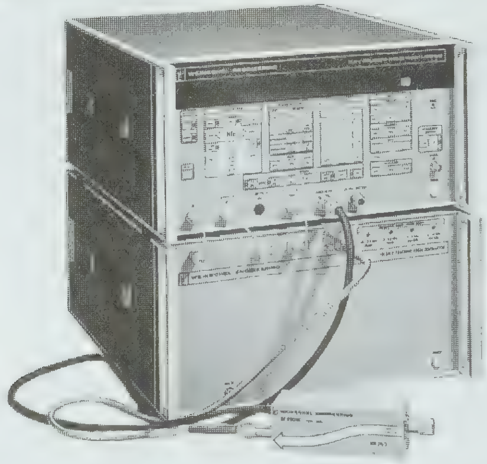
Figure 1. VM-4/1619 Measurement System

Model VM-24

SIGNAL GENERATOR CALIBRATOR

0.01 to 18 GHz

IEEE - 488



Six Instruments in One

The VM-24 Signal Generator Calibrator offers the equivalent of six precision test instruments for the 0.01 to 18 GHz spectrum--all within one integrated microprocessor controlled instrument. It is suitable for the calibration of **all** signal sources, from free running to synthesized. The VM-24's six instruments include:

POWER METER - Measures +20 to -100 dBm with ± 0.2 dB accuracy from 0.01 to 12.4 GHz. Measures +20 to -90 dBm with ± 0.3 dB accuracy from 12.4 to 18 GHz. The Power Meter probes are individually calibrated at all 109 NIST traceable frequencies plus 30 MHz. The calibration factors are stored in the probe and are automatically uploaded to the VM-24 on power up or when the probe is replaced. No manual entering of data required.

ATTENUATOR CALIBRATOR - Measures 0 to 100 dB with 0.001 dB resolution with an accuracy of 0.01 to 0.03 dB/10 dB.

TEST GENERATOR - Provides a 30 MHz RF calibration signal at 0, -20 and -30 dBm with 30% AM or 50 KHz peak deviation FM.

FREQUENCY COUNTER - Measures 0.01 to 12.4 GHz to -100 dBm and 12.4 to 18.0 GHz to -90 dBm with ± 0.0001% ± 1 count accuracy. Measures 30 Hz to 10 MHz at 50 mV with ± 1 Hz, ± 1 count accuracy.

AM MODULATION METER - Measures 0 % to 90 % modulation on two ranges with an accuracy of ± 2 % full scale.

FM MODULATION METER - Measures 0 to 300 kHz peak deviation on five ranges with an accuracy of ± 2 % full scale (to 1 MHz peak deviation with slightly reduced accuracy).

OTHER SYSTEM FEATURES -

- **AUTOTRACK LOCAL OSCILLATOR** - Locks onto signal and holds lock--even with signal sources which are drifting or have high incidental FM. Makes unit perfect for Klystron based generators, unlock or locked YIG sources, etc.
- **DIRECT OPERATOR INTERACTION** - The selected test parameters, operator prompting messages, and measurement results are immediately displayed on an easy-to-read 40-character alphanumeric display.
- **MICROPROCESSOR CONTROL** - A tolerance factor, preselected by the operator, is available for immediate pass or fail indication.
- **MANUAL, LOCAL, AND REMOTE OPERATION** - Test parameters may be selected via front panel controls, programmed locally (up to 200 steps) or by using an IEEE bus controller. Five operating modes provide system flexibility.
- **SELF TEST ROUTINES** - An internal 30 MHz signal performs a self check of all power, frequency and modulation measurement circuits. The microprocessor self-test routine checks all front panel LEDs, RAM and ROM memory, CPU, front-panel display logic, and the 40-character alphanumeric display.
- **NO COMPLICATED TEST SET-UPS** - One probe does it all!

Model VM-24
Signal Generator Calibrator

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

FREQUENCY RANGE: 30 Hz to 18 GHz

RF POWER MEASUREMENTS:

Power Range:

0.01 to 12.4 GHz:	+20 to -100 dBm
12.4 to 18 GHz:	+20 to -90 dBm

Resolution: 0.01 dB

ACCURACY (ABSOLUTE):

± 0.2 dB 10 MHz to 12.4 GHz
± 0.3 dB 12.4 GHz to 18 GHz

Input Impedance: 50 Ω nominal

SWR:

Frequency (GHz)	SWR	Power Range
0.010 - 2.0	1.10	0 to -50 dBm
2.0 - 12.4	1.15	0 to -50 dBm
12.4 - 18.0	1.20	0 to -45 dBm

With probes removed:

Frequency (GHz)	SWR	Power Range
0.010 - 2.0	2.0	-50 to -100 dBm
2.0 - 12.4	2.0	-50 to -100 dBm
12.4 - 18.0	2.0	-45 to -90 dBm

Masking Attenuator SWR:

dc - 4 GHz:	1.10
4 - 12.4 GHz:	1.15
12.4 - 18 GHz:	1.20

6 dB masking attenuator can be included to improve SWR.

RF ATTENUATION MEASUREMENTS:

Frequency Range: 0.01 to 18 GHz

Dynamic Range: > 100 dB when used with power meter, ± 0.02 dB/10 dB

Resolution: 0.001 dB

Accuracy:

0.01 - 12.4 GHz:	+20 to -20 dBm:	± 0.02 dB/10 dB
	-20 to -80 dBm:	± 0.01 dB/10 dB
	-80 to -100 dBm:	± 0.03 dB/10 dB
12.4 - 18 GHz:	+20 to -20 dBm:	± 0.02 dB/10 dB
	-20 to -70 dBm:	± 0.01 dB/10 dB
	-70 to -90 dBm:	± 0.03 dB/10 dB

AM MODULATION MEASUREMENTS:

Carrier Frequency Range: 0.01 to 18 GHz

Modulation Frequency Range: 0.03 to 10 KHz

Percent Modulation Range: 0 to 90%

Power Range: +10 to -60 dBm

Accuracy: ± 2% of full scale (2 scales: 30% and 100% mod)

Resolution: 4 digits or 0.1 Hz

Display: Average peak, peak positive, and peak negative

FM MODULATION MEASUREMENTS:

Carrier Frequency Range: 0.01 to 18 GHz

Modulation Frequency Range: 0.03 to 10 KHz

Peak Deviation Range*: 0 to 300 kHz

Power Range: +10 dBm to -60 dBm

Accuracy*: 2% of full scale + 15 Hz per 100 MHz carrier frequency (5 scales: 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz FM devation)

Resolution: 4 digits or 0.1 Hz

Display: Average peak, peak positive, and peak negative

* 300 kHz to 1 MHz with slightly reduced accuracy

SPECIFICATIONS (Con't)

INTERNAL SIGNAL SOURCE:

Frequency:	30 MHz
Power Range: 0 dBm ± 0.1 dB, accuracy of precise 10 dB step from -20 to -30 dBm is ± 0.05 dB.	
Signal Purity @ 0 dBm	
Non-Harmonically Related Signals (noise): > 500 Hz from carrier measured in 100 Hz bandwidth, spurious signals < -40 dBm > 10 kHz from carrier measured in 100 Hz bandwidth, spurious signals < -70 dBm IF sidebands @ ± 500 kHz -66 dBm Harmonic Content -50 dBm	
AM Modulation: 30 ± 0.6% with 1 kHz modulation DRIFT: < 0.1% after 10 second setting time SYMMETRY: (Difference between positive and negative peaks) ± 0.20 %	
FM Modulation: 50 kHz peak ± 1 kHz with 1 kHz modulation DRIFT: 0.2 kHz after 10 second setting time SYMMETRY: (Difference between positive and negative peaks) ± 1.0 kHz	

POWER METER (@ 23 ˚C ambient):

Short Term Stability: @ 0 dBm < ± 0.01 dB in high resolution @ -10 dBm <± 0.01 dB in high resolution	
Drift (after initial warmup): @ 0 dBm < 0.01 dB/hour @ -10 dBm < 0.01 dB/hour	
IF Vector Nulling Loop: Drift (after initial warmup):	0 to -80 dBm < 0.02 dB/hour

FREQUENCY MEASUREMENTS:

Frequency Range:	30 Hz to 18 GHz
Sensitivity:	-100 dBm, 10 MHz to 12.4 GHz -90 dBM, 12.4 GHz to 18 GHz 50 mV, 30 Hz to 10 MHz
Accuracy:	0.01 to 18 GHz 0.0001%, ± 1 count 30 Hz to 10 MHz ± 1 Hz ± 1 count
Resolution:	10 Hz to 9.9999999 MHz: 0.1 Hz 10 MHz to 18.0 GHz: 8 digits

REMOTE CONTROL: Configured for IEEE Std-488-1975 GPIB bus controlled by suitable calculator or computer such as HP-85, Series 200 or any PC compatible system controller.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors.

TEMPERATURE RANGE:

Operating : +10 ˚C to +40 ˚C (+25 ˚Fto 104 ˚F)
Storage : -40 ˚C to +75 ˚C (-67 ˚F to +167 ˚F)

POWER REQUIREMENTS: 115 V ± 10%, 50 to 400 Hz, Switch Selectable to 230 V ± 10%

WEIGHT: Approximately 27 kg (60 lbs) (each unit)

PHYSICAL DIMENSIONS (Each Unit):

Height: 216 mm (8.5 in)
Width: 425 mm (16.75 in) standard rack width
Depth: 521 mm (20.5 in)

ACCESSORIES

SPARE MODULE KIT: Lucas Weinschel offers a spare module kit (P/N 191-264) for the Model VM-24. This kit includes all replaceable module assemblies that can be easily replaced at any location.

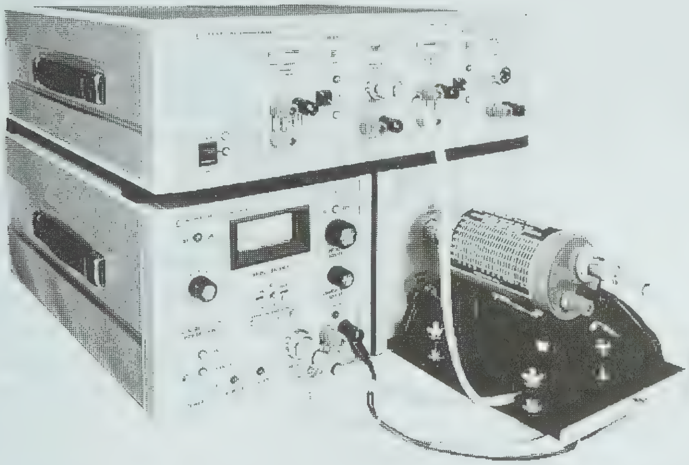
RACK MOUNTING: The Model VM-24 can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 190-499) or Rack Mount Adapters and Side Panels for Chassis Slides (P/N 190-500).

SYSTEM IIA
AUTOMATIC POWER METER CALIBRATION SYSTEM

10 MHz to 18 GHz

(expandable 100 KHz to 40 GHz)

IEEE - 488



For use in Laboratories, Quality Assurance Inspection, Maintenance Depots, or Production Lines

Simplicity, Accuracy, and Cost Effectiveness...

Calibration of RF power meter/mount combinations is faster and more accurate than ever before when using the Lucas Weinschel System IIA. System IIA is IEEE-488 bus controlled and transforms a slow and costly task into a quick and accurate procedure.

The calibration accuracy of System IIA is typically less than 1% above accuracies provided directly by the National Institute of Standards and Technology (NIST), including mismatch uncertainties. Total accuracy is less than 1.2 to 2.5% (RSS) depending on frequency and VSWR of the device under test.

Calibration speed of the System IIA is typically 5 seconds per measurement frequency, depending on settling time of the power sensor/meter under test. System IIA is used for the transfer of calibration factors to thermistor and thermocouple as well as diode-type RF Power Meter sensors. Accurate measurement of signal source output level can also be performed. Using power ratio methods, variable and step attenuators and attenuation measuring equipment can be calibrated as well as measurement of receiver, amplifier, or attenuator linearity. The System IIA can perform many other functions such as:

- Measuring Calibration Factors of RF Power Meters (analog or digital) and RF Power Transfer Standards (Terminating and Feedthrough Mounts).
- Measuring linearity of detectors, variable attenuators, receivers, amplifiers and spectrum analysers.
- Compression ratios at high signal levels.
- Compression due to noise at low signal levels.
- Compare Power Standards.
- Calibrate Piston Attenuators.

Other System IIA features include:

- Accuracies < 1% (RSS) above that provided directly by NIST
- 0.01 to 18 GHz frequency range with 109 NIST traceable calibration points--expandable up to 40 GHz and down to 100 KHz
- Total system accuracy for the transfer of calibration factors 1.2% to 2.5% (RSS) in the 0.01 to 18 GHz range
- 5 seconds/measurement includes signal averaging and meter settling time
- Test Ports - N Male/Female or 7 mm
- Substituted power levels 0.5 mW and 1.0 to 10 mW in 1 mW steps ± 0.1% + 1 µW
- Calibration factor transfer repeatability 0.1%

PRECISION RF POWER SOURCE:

In its most elementary form, System IIA consists of an RF Control Unit (Model 1805B) and a temperature stabilized feedthrough type bolometric power standard (Model 1109). When used with a compatible RF source, you have everything required for the accurate transfer of calibration factors for a wide range of power meters and sensors. When used in conjunction with an IEEE-488 bus controller, you have a fast, automatic, precision power meter calibration system.

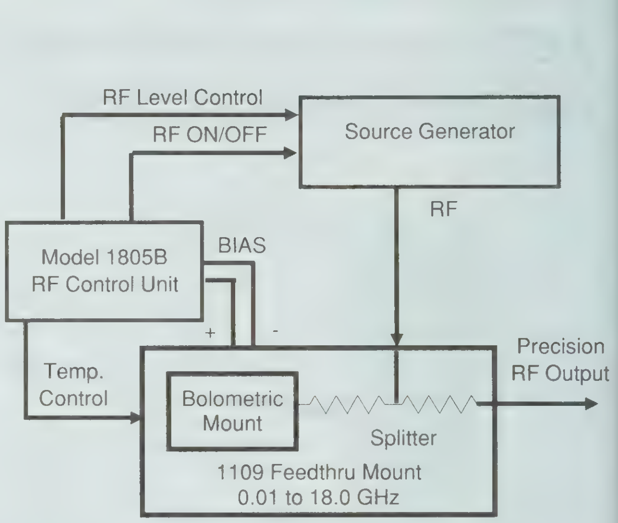
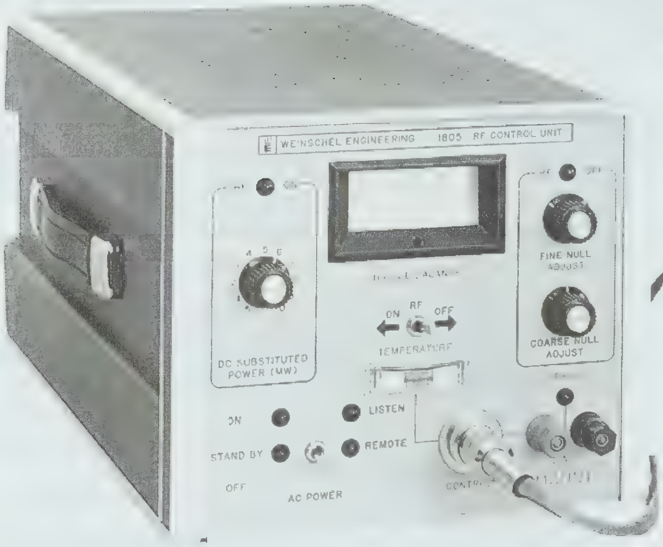
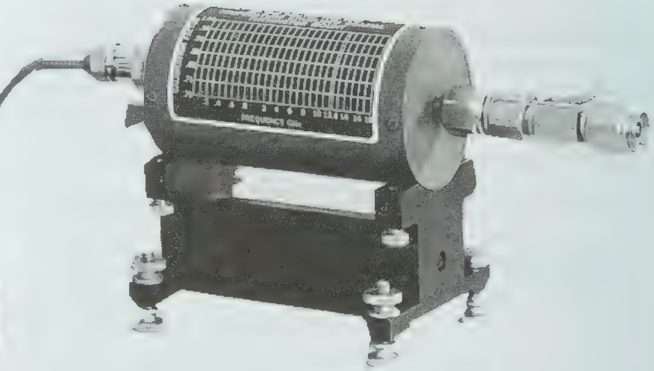

RF Level Control
RF ON/OFF
Source Generator
RF
Model 1805B
RF Control Unit
BIAS
+
-
Precision
RF Output
Temp.
Control
Bolometric
Mount
Splitter
1109 Feedthru Mount
0.01 to 18.0 GHz

Figure 1. Precision RF Power Source


WEINSCHEL ENGINEERING 1805 RF CONTROL UNIT
FINE NULL ADJUST
COARSE NULL ADJUST
DC SUBSTITUTED POWER (MW)
RF
ON
OFF
TEMPERATURE
LISTEN
REMOTE
STAND BY
AC POWER

MODEL 1805B



MODEL 1109

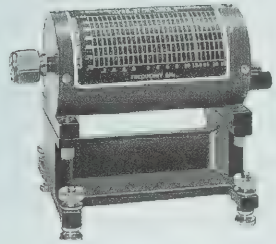
The Model 1109 permits the accurate transfer of calibration data traceable to NIST from 0.01 to 18 GHz. Additional points within this range can be accurately determined by interpolation due to the unusually flat frequency response of the thermistor mount/splitter combination.

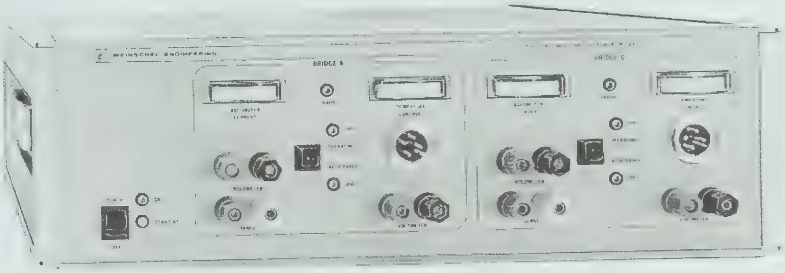
The 1805B uses highly accurate dc power substitution in a precision RF leveling loop. Power levels are established by precision resistor networks at dc, and are verifiable by an accurate dc voltmeter.

With a Lucas Weinschel Synthesized Signal Source, 1 MHz resolution can be programmed from 0.01 to 18 GHz on the IEEE 488 bus.

Eleven precision power levels of 0.5 and 1 to 10 mW in 1 milliwatt steps permit the verification and/or calibration of the linearity of measurement devices such as power meters (meter scales), power meter/mount combinations, spectrum analysers and receivers (to achieve a 10 mW power level, a signal source with an output of 100 mW is generally necessary).

PRECISION RF POWER METER





With the addition of a Terminating Bolometric-type Power Standard (Model 1110) and a Model 1806 Dual NIST Type IV Power Meter, System IIA capability is expanded so that recertification of the Model 1109 feed-through type power standard can be accomplished at the user's location. This avoids the requirement for removing the system from service for recalibration. Recertification can be accomplished automatically in less than 2 hours time. The Model 1110 becomes the certifying element and would be periodically (every 1 - 2 years) sent to a calibration facility such as Lucas Weinschel, the National Institute of Standards and Technology (NIST), or any equivalent service outside the USA.

The Model 1806 is a dual NIST Type IV power meter and mount temperature controller combination. Metering circuits indicate status of both the power meters and the mount temperature. Mount resistance is front panel switch selectable to accommodate either 100 or 200 ohm thermistor mounts. The 1806 provides +0.03% + 2 µW accuracy and measures dc power levels from 10 mW to 30 mW.

Used in conjunction with a calibrated bolometer mount such as the Lucas Weinschel 1109 or 1110 and an external digital voltmeter, the Model 1806 serves as a precision power meter for measuring RF power levels and for transferring calibration factors between feed-through mounts or sensors. Additionally, the Model 1806 is ideal for performing insertion loss measurements up to 20 dB.

Regardless of the application, all measurements can be directly traced to primary NIST standards. The 1806 is also compatible with the Models 1111 and 1116 series Coaxial RF power Transfer Standards and the Model 1107 series Waveguide Standards.

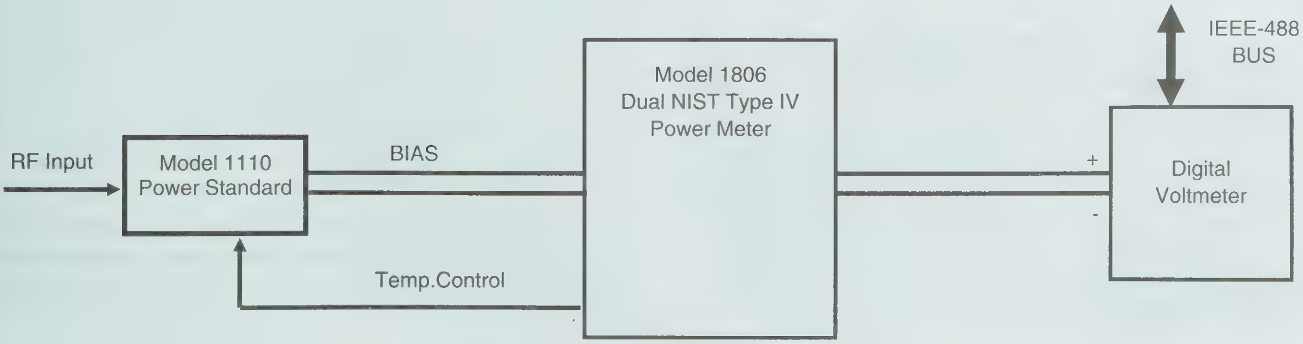


Figure 2. Precision Power Meter

MEASUREMENT CONFIGURATION

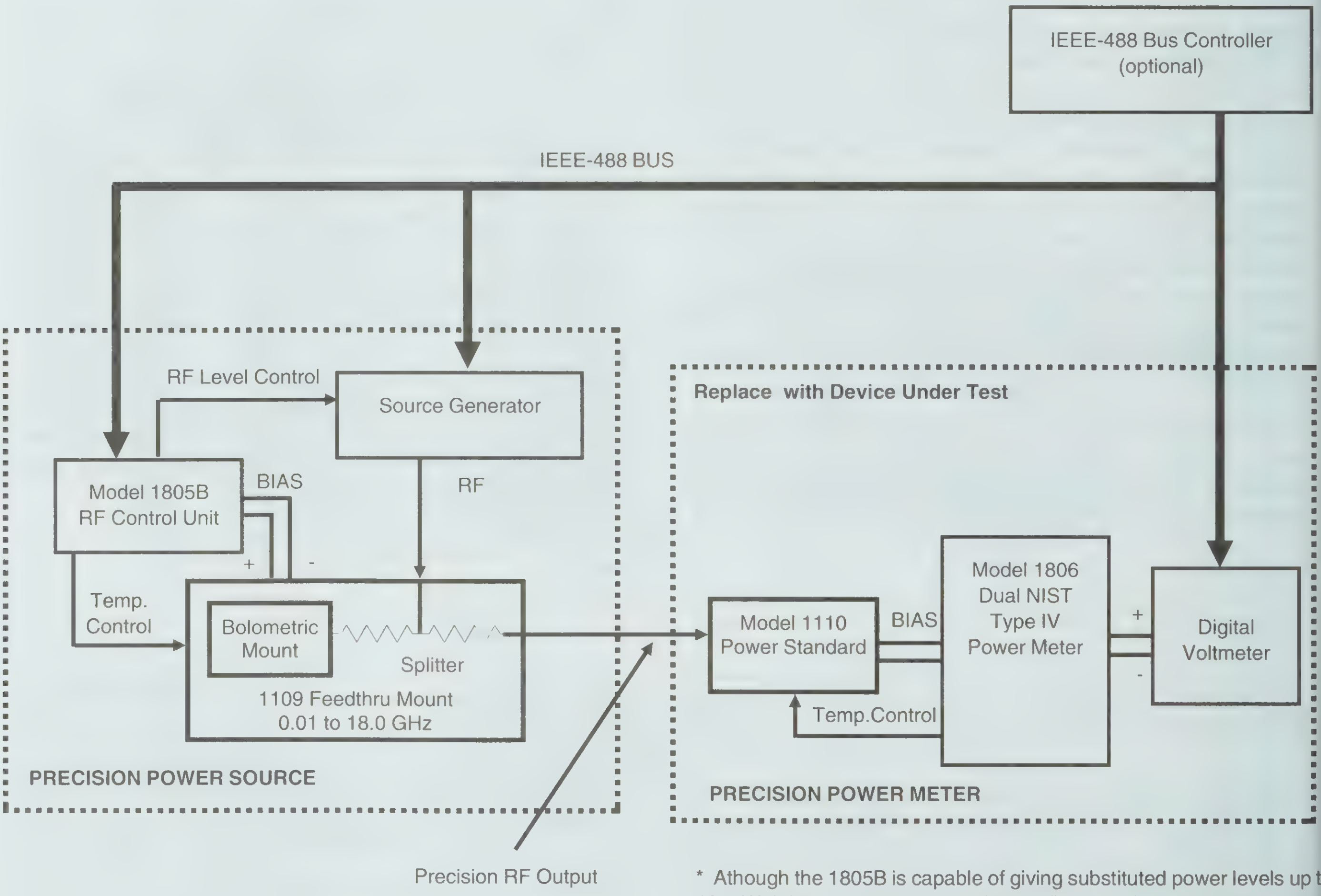
As shown in Figure 3, the 1805B RF Control Unit, the 1109 feed-through type power standard, and an RF signal source form a Precision Power Source.

The 1110 terminating type power standard, 1806 NIST Type IV power meter, and DVM form a Precision Power Meter.

With this arrangement the 1110 power standard is used to calibrate or validate the calibration accuracy of the 1109 feed-through mount. The 1109 is then used as a standard for the transfer of calibration factor to power sensors and power meters. This is accomplished by replacing the 1806 Type IV power meter and the 1110 termination mount with an analog or digital power meter and the power sensor under test.

The analog power meter under test must have an external output port similar in function to the RECORDER OUTPUT port provided on an HP-432 power meter. The external output port is then connected to a digital voltmeter which serves as an IEEE-488 bus communicator.

When used on an IEEE-488 bus, the precision power source automatically sequences through preselected frequencies and power levels, measures the dc substituted power at the output of the mount under test, and calculates the calibration factor.


IEEE-488 Bus Controller (optional)
IEEE-488 BUS
RF Level Control
Source Generator
Model 1805B RF Control Unit
BIAS
RF
+
-
Temp. Control
Bolometric Mount
Splitter
1109 Feedthru Mount 0.01 to 18.0 GHz
PRECISION POWER SOURCE
Replace with Device Under Test
Model 1110 Power Standard
BIAS
Model 1806 Dual NIST Type IV Power Meter
+
-
Digital Voltmeter
Temp.Control
PRECISION POWER METER
Precision RF Output

* Athough the 1805B is capable of giving substituted power levels up to 10 mW, it is necessary to provide an RF output from the signal source of > 100 mW for the 1805B to operate at that level.

Figure 3. System IIA Measurement Configuration

MEASUREMENT FLEXIBILITY

In addition to the basic task of transferring calibration factors and the measurement of power level and attenuation, System IIA can be easily expanded to offer a wide range of measurement capabilities. Lucas Weinschel mounts and mount splitter combinations are available to extend the measurement frequency range down to 100 KHz, while mount coupler combinations are available for measurements in the 18 to 26.5 GHz and 26.5 to 40 GHz ranges.

The terminating bolometer mount (Model 1110) can be used to calibrate the reference output found on many power meters which serve thermocouple and semiconductor (diode) power sensors. The Lucas Weinschel Model 1111 provides even better accuracy at 30 and 50 MHz because of its unusually low SWR.

Additionally, System IIA can be used to verify the accuracy and linearity of spectrum analzers and receivers such as the Lucas Weinschel VM-4, VM-7 and the VM-24.

OPERATIONAL FLEXIBILITY

SELF CALIBRATING - The Model 1110 Bolometric Power Standard enables the user to calibrate or verify calibration of the 1109 power mount. Therefore the system is easily calibrated. Measurement accuracy is constantly maintained and system operation is quickly and easily verified. Unlike other methods, System IIA is not interrupted while the power reference standard is sent to a higher echelon laboratory for recalibration.

ONE MODEL 1110 CAN BE USED TO SUPPORT ANY NUMBER OF SYSTEM IIA'S - One Model 1110 can be used to verify and/or calibrate other Model 1109 power standards used by satellite sites or other areas within the same facility. Thus, one Model 1110 can support any number of other System IIA's. This is ideal when more than one System IIA is required to support Production, Quality Assurance, and R&D activities.

NIST TRACEABLE - The 1110 can be sent directly to NIST for calibration. This provides a two-fold benefit. System accuracy is traced directly to NIST and down time is avoided since the Model 1110 is not used in the day-to-day operation of System IIA.

WIDE FREQUENCY RANGE - When used with other Weinschel precision power standards and adapters, System IIA can be used for the accurate transfer of calibration factors from 100 kHz to 40 GHz.

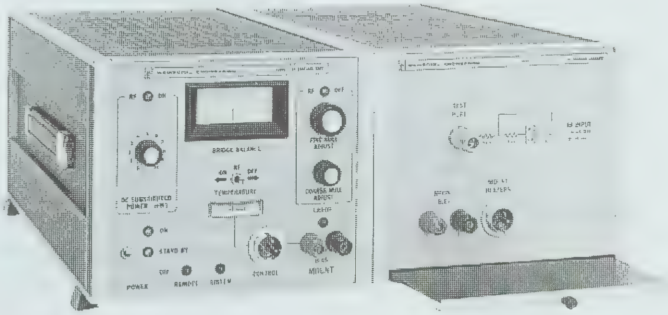
MANUAL OR REMOTE CONTROL - System IIA operation may be controlled manually via front panel controls or by a system controller when used on an IEEE-488 bus. Software supplied with System IIA accommodates a wide variety of power meters and sensors.

OPERATING CONVENIENCE

The Weinschel Model 1807A RF Transfer Standard combines the temperature stabilized feed-through type bolometer standard/splitter in a convenient companion unit to the 1805B RF Control Unit. The 1807A provides additional mechanical stability for the power standard test port, and facilitates the use of torque wrenches for even greater precision.

A slide-out tray, located in the bottom portion of the 1807A, provides a stable work platform when calibrating the system with a Lucas Weinschel 1110 terminating mount. Other sensors can be supported for safety with blocks or a lab jack as well

The 1807A and 1805B units may be ordered as shown in a bench mount configuration, or with rack mounting kit number 1919 for standard rack mounting.



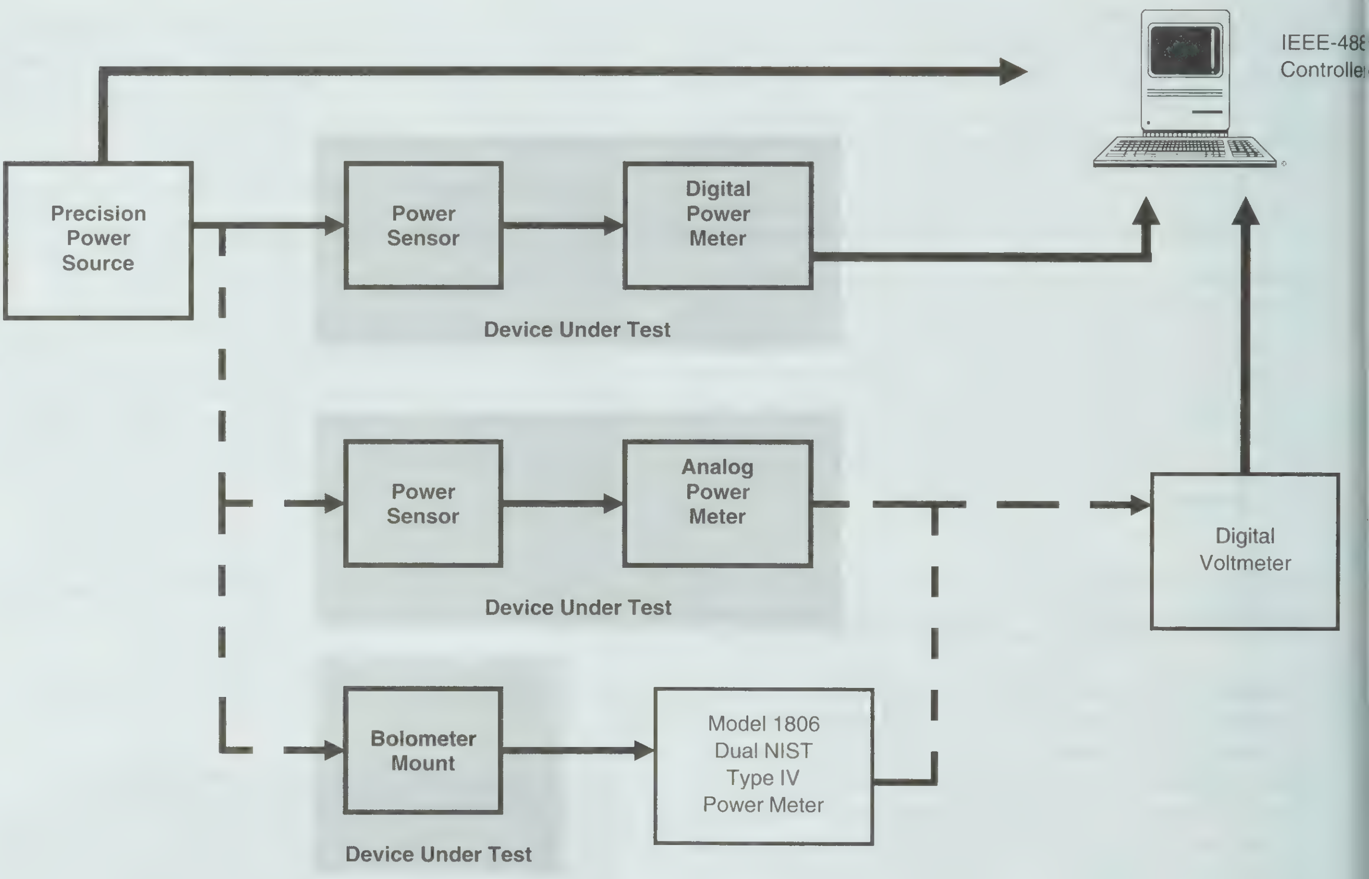
APPLICATIONS

In a typical application, calibrating an HP-436A power meter and its associated power sensor, the 1109 (or 1807A) is used as the reference standard to establish the calibration factor of the power meter and sensor under test. To calibrate the 50 MHz reference output port of the 436A power meter, the 1110 can be used. However, even greater accuracy is obtained by using a Lucas Weinschel 1111 terminating mount. The Lucas Weinschel 1111 has a maximum SWR of 1.2 (1.05 typical) while the 1110 has a maximum SWR of 1.4 (1.1 typical) at 50 MHz. The Model 1806 Dual NIST Type IV Power Meter can also be used to supply bias power and thermostatic heater control for the 1111 power standard.

If an 1111 is used to calibrate the 50 MHz reference output of the HP-436, the 1110 may be sent to Lucas Weinschel, NIST, or equivalent calibration standards laboratory for recalibration without disabling the full calibration capability of System IIA.

The System IIA software package incorporates program instructions for using the following digital voltmeters to interface with the IEEE-488 bus controller when using the 1806 dual NIST Type IV power meter or when calibrating analog-type power meters that have an external output port:

- Fluke 8502 or 8505
- Keithley 192
- HP-3455, 3478


IEEE-48
Controlle
Precision Power Source
Power Sensor
Digital Power Meter
Device Under Test
Power Sensor
Analog Power Meter
Device Under Test
Digital Voltmeter
Bolometer Mount
Model 1806 Dual NIST Type IV Power Meter
Device Under Test

Power meters are automatically calibrated by System IIA. Digital power meters with bus output may be connected directly to the controller. Analog power meters that have an external output port may be calibrated by connecting them to the controller through a digital voltmeter. A digital power meter without IEEE option may be used via DVM.

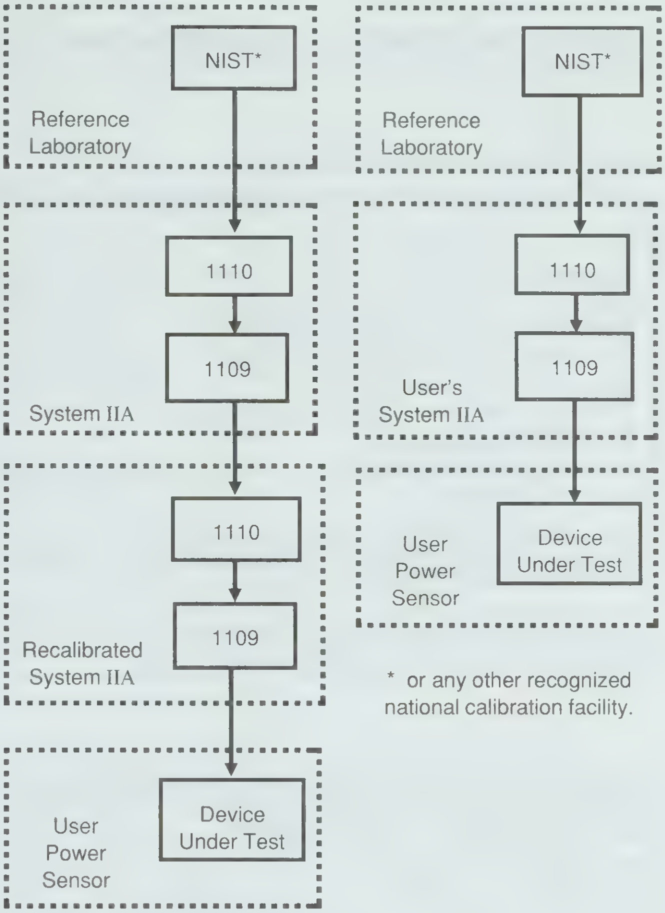
Figure 4. System IIA Applications

NIST TRACEABILITY

The calibration factor from a NIST calibrated Model 1110 terminating power standard is transferred to the System IIA 1109 feedthrough power standard with a typical loss of only 1/2 of 1% in transfer uncertainty for 109 traceable frequencies.

As shown in Figure 5, traceability of the Model 1110 mount supplied as a part of System IIA is derived from the Lucas Weinschel Calibration Lab Model 1109. An additional loss of 1/2 of 1% in transfer uncertainty occurs with this method due to the three tiers of calibration. A summary of System IIA errors incurred during this transfer of calibration factors are provided on page 155 (Instrumentation Errors). As an alternative, System IIA can be specified with Model 1110 mounts calibrated directly by NIST, also shown in Figure 5. The NIST calibrated Model 1110 can be returned to NIST for recalibration on an annual or biennial basis.

Depending on logistics, a user of multi-System IIA installations may elect to maintain traceability using a single Model 1110 thermistor mount on a rotational basis between sites and the main reference laboratory. To accommodate such requirements, System IIA can be ordered without Model 1110 terminating mounts.



* or any other recognized national calibration facility.

Figure 5. Traceability

SPECIFICATIONS

The following is a summary of System IIA specifications. Specifications for each individual system component can be found on its applicable data sheet.

FREQUENCY RANGE:

0.01 - 18 GHz, standard System IIA (1109, 1110)
0.1 - 100 MHz, expanded System IIA (1111, 1116)
18 - 26.5 GHz, expanded System IIA (1107-7)
26.5 - 40 GHz, expanded System IIA (1107-8)

IMPEDANCE: 50 Ω nominal

CALIBRATION FACTOR STABILITY: < 0.5% per year.

CALIBRATION FACTOR POWER DEPENDENCE: < 0.1% from 1 mW, negligible to maximum useful limit.

POWER MEASUREMENT RANGE: 10 μW to 25 mW

RESISTANCE AT BIAS: 200 Ω

TEMPERATURE COEFFICIENT OF RESISTANCE: Negative

CALIBRATION: Individual calibrations traceable to NIST supplied at following frequencies:

0.01, 0.05, 0.1, 0.5 GHz
1.0 - 2.0 GHz in 50 MHz increments
2.1 - 4.0 GHz in 100 MHz increments
4.2 - 12.4 GHz in 200 MHz increments
12.75 - 18.0 GHz in 250 MHz increments

POWER SENSITIVITY OF RESISTANCE: -13 Ω/mW

THERMISTOR BIAS POWER: 30 mW ± 0.7 mW with temperature control.

TEMPERATURE RANGE:

Operating : +10 °C to +40 °C (+25 °F to 104 °F)
Storage : -40 °C to +75 °C (-67 °F to +167 °F)

SUMMARY OF SYSTEM IIA ERRORS:

Calibrating an 1109 WPC feedthrough mount with a NIST calibrated 1110 WPC terminating mount results in the following errors in worst case and RSS terms.

Instrumentation Errors:

Source of Error	Error	Calibration of 1109 with 1110 @ 10 mW	Calibration of 1110 with 1109 @ 10 mW
Inaccuracy of DC substitution (1805B)	0.1% + 5 µW	0.15 %	0.15 %
Inaccuracy of DC substitution (1806)	0.03 % + 2 µW	0.05 %	0.05 %
Connector Repeatability	0.1%	0.1%	0.1%
Temperature Drift of Thermistor Mount	0.05 %	0.05 %	0.05 %
Thermistor Unbalance	0.1%	0*	0*
Instability or Calibration Factor with Time	0.1%	0.1%	0**
Total Instrumentation Error Worst Case	0.48 % + 7 µW	0.45%	0.35%
Total Instrumentation Error RSS		0.22%	0.19%

* Measurements made at the same power level.
** Calibrations made at nearly the same time.

Lucas Weinschel bolometer mounts exhibit excellent RF impedance characteristics as shown below. This ensures the accurate transfer of calibration factor. Typical uncertainties on a recent calibration were less than 1% with only a few points reaching 1.9%. System IIA errors are further reduced by accuracy analysis using the Root-Sum-Squared method (RSS).

Mismatch Errors:

FREQUENCY RANGE	1111 SWR Specified	1111 SWR Typical	1110 SWR Specified	1110 SWR Typical	1109 SWR Specified	1109 SWR Typical	MISMATCH Specified	MISMATCH Typical
10-20 MHz	1.10	0.05	1.60	1.40	1.06	1.01	1.38 %	0.17 %
20-50 MHz	1.20	1.06	1.40	1.25	1.06	1.02	1.02 %	0.22 %
50-100 MHz	1.20	1.10	1.30	1.15	1.06	1.03	0.78 %	0.21 %
100-1000 MHz			1.20	1.10	1.06	1.03	0.54 %	0.15 %
1.0-3.5 GHz			1.20	1.10	1.06	1.03	0.54 %	0.15 %
3.5-4.0 GHz			1.20	1.10	1.06	1.03	0.54 %	0.15 %
4.0-8.0 GHz			1.30	1.20	1.06	1.04	0.78 %	0.36 %
8.0-18.0 GHz			1.40	1.25	1.10	1.08	1.71 %	0.88 %

Automatic Power Meter Calibration System

The following table provides a worst case and RSS analysis of errors when calibrating an HP-8481 power sensor using an 1109 power standard.

Errors in Calibrating 8481 Power Sensor 1109:*

FREQUENCY RANGE	SWR	MISMATCH ERROR Specified	MISMATCH ERROR Typical	WORST CASE** Specified	WORST CASE** Typical	RSS** Specified	RSS** Typical
10-30 MHz	1.40	1.00 %	0.33 %	4.18 %	2.35 %	1.84 %	1.22 %
30-50 MHz	1.18	0.50 %	0.17 %	3.32 %	2.19 %	1.62 %	1.19 %
50-2000 MHz	1.10	0.29 %	0.14 %	3.13 %	2.59 %	1.72 %	1.61 %
2-12.4 GHz	1.18	0.80 %	0.63 %	5.31 %	4.31 %	2.81 %	2.34 %
12.4-18 GHz	1.28	1.18 %	0.94 %	5.69 %	4.62 %	2.94 %	2.45 %

* In this example, the 1109 has been calibrated by a Lucas Weinschel 1110 which has been NIST calibrated. If the 1110 has been Lucas Weinschel calibrated, additional errors result. (Refer to System IIA Errors)

** This does not include instrument errors of the associated power meter which may be ± 1.2% worst case or ± 0.9% RSS.

A comparison of total System IIA errors (worst case and RSS) is as shown below. This table also shows total errors derived using a NIST calibrated 1110. Using the RSS method, System IIA errors can be shown to be approximately 60 percent of those in the worst case analysis.

Total System IIA Errors:

	MODEL 1109 LUCAS WEINSCHEL CALIBRATED				MODEL 1110 LUCAS WEINSCHEL CALIBRATED				
FREQUENCY RANGE	Worst Case Spec	Worst Case Typical	RSS** Spec	RSS** Typical	Worst Case Spec	Worst Case Typical	RSS** Spec	RSS** Typical	NIST* Calibrated
10-20 MHz	2.83 %	1.62 %	1.76 %	1.11 %	4.56 %	2.14 %	2.26 %	1.18 %	1.0 %
20-50 MHz	2.47 %	1.67 %	1.50 %	1.12 %	3.84 %	2.24 %	1.85 %	1.19 %	1.0 %
50-100 MHz	2.23 %	1.66 %	1.35 %	1.12 %	3.36 %	2.22 %	1.60 %	1.19 %	1.0 %
100-1000 MHz	1.99 %	1.60 %	1.22 %	1.11 %	2.88 %	2.10 %	1.38 %	1.17 %	1.0 %
1.0-3.5 GHz	2.49 %	2.10 %	1.66 %	1.57 %	3.38 %	2.60 %	1.78 %	1.62 %	1.5 %
3.5-4.0 GHz	2.99 %	2.60 %	2.12 %	2.06 %	3.88 %	3.10 %	2.22 %	2.09 %	2.0 %
4.0-8.0 GHz	3.23 %	2.81 %	2.19 %	2.08 %	4.36 %	3.52 %	2.35 %	2.14 %	2.0 %
8.0-18.0 GHz	4.16 %	3.33 %	2.67 %	2.23 %	6.22 %	4.56 %	3.19 %	2.42 %	2.0 %

* NIST Special Publication 250, 1980 Edition, Paragraph H, pp. 60 through 62.

** The Root-Sum-Squared (RSS) error is the square root of the sum of the squares of the individual errors which are considered to be random.

ORDERING GUIDE

System IIA is available in three different configurations: Basic, Intermediate, and Advanced. Each of these offer special options to further suit user needs.

BASIC SYSTEM: Lucas Weinschel offers two different connector options (Type N and GPC-7) for the Basic System. The Basic Type N System (System IIA-B) includes:

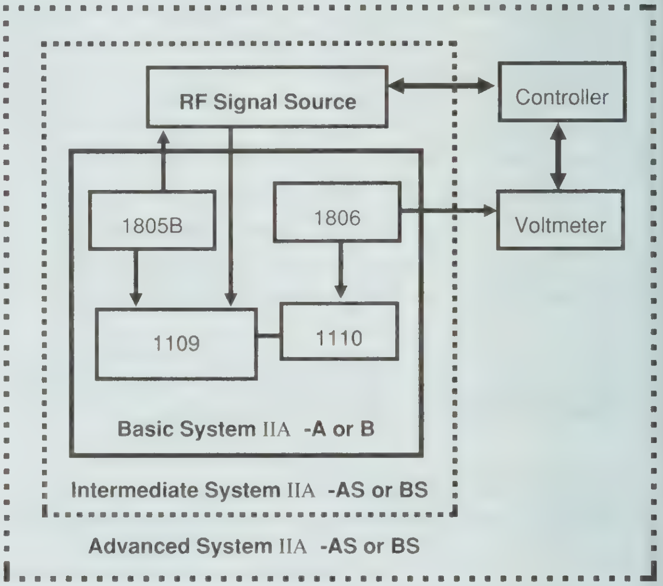
Qty	Model	Item Description
1	1805B	RF Level Controller
1	1806	Dual NIST Type IV Power Meter
1	F1109	Feedthrough Thermistor Mount
1	M1110	Terminating Thermistor Mount
1	M1567	Precision GPC-7 to N Male
1	F1567	Precision GPC-7 to N Female
1	M1513	Precision N Male to N Male
1	1585-1000	Low Loss RF Cable 3 ft
3	7002-14	Type N Male to SMA Female Adapters
1	189-3-X	System IIA Software (dash # indicates software format, refer to System Software (page 157)

The GPC-7 System (System IIA-A) utilizes a Model 1109 WPC and 1110 WPC. All other items are identical, except the necessary adapter changes.

INTERMEDIATE SYSTEM: This system includes all components of the Basic system using GPC-7 or Type N connectors plus an RF Signal Source.

ADVANCED SYSTEM: This system includes all components of the Basic system using GPC-7 or Type N connectors plus an RF Signal Source, a PC compatible controller and 6-1/2 digit IEEE-488 bus controllable voltmeter.

SELECT THE CONFIGURATION THAT MEETS YOUR OWN NEEDS . . .



	GPC-7 Connectors	Type N Connectors	1805B	1806	1110 *	1109	Software & Adapters	1807A	1807A-WPC	RF Signal Source	PC Compatible & DVM
System IIA-A	•		•	•	•	•	•				
System IIA-B		•	•	•	•	•	•				
System IIA-A-807	•		•	•	•		•		•		
System IIA-B-807		•	•	•	•		•	•			
System IIA-AS	•		•	•	•	•	•			•	
System IIA-BS		•	•	•	•	•	•			•	
System IIA-AS-807	•		•	•	•		•		•	•	
System IIA-BS-807		•	•	•	•		•	•		•	
System IIA-ASC	•		•	•	•	•	•			•	•
System IIA-BSC		•	•	•	•	•	•			•	•
System IIA-ASC-807	•		•	•	•		•		•	•	•
System IIA-BSC-807		•	•	•	•		•	•		•	•

* All versions of System IIA can be obtained with 1110 terminating mounts calibrated directly by the National Institute of Standards and Technology. Delivery of these Systems is determined by NIST calibration schedules which can add up to four months to factory availability. Contact factory for price and delivery of this service. In applications where several systems are to be deployed, traceability may be supported by a single 1110. In this case, the fielded systems can be specified without the 1110 thermistor mount by adding the suffix NK1 to the model number.

ACCESSORIES

SYSTEM SOFTWARE: Lucas Weinschel offers a System IIA software package (P/N 189-15) that allows the user to perform automatic calibration and transfer of calibration factors for the most commonly used power sensors and power meters. Both analog and digital power meters can be calibrated with or without the IEEE-488 bus options. Typically, a 10 MHz to 18 GHz power sensor can be calibrated at all standard NIST calibration frequencies in less than 5 minutes.

The software is menu driven and operates on an IBM PC or Compatible that contains a GPIB interface and HT Basic software or HP 9000-200/300 series Controllers. This software also performs the direct transfer and storage of calibration factors from a Standard terminating mount to the feedthru working standard thermistor mount.

This software is very flexible and gives the user wide latitude in the selection of signal sources and digital voltmeters that can be used with the System IIA. Contact the factory if you have questions regarding specific models.

Data files may be modified, viewed, listed or graphed and new data files can be created including data files for adapters and attenuators. Complex reflection coefficients can be stored for both the calibrator and the unit under test, so the user can correct for mismatch uncertainties. This software can perform error correction to remove mismatch errors associated with the use of two-port devices such as adapters and/or attenuators used in the test setup during the calibration. Uses two-port scattering (S) parameter data for the device.

This software allows the user to print the final calibration data in tabular form and can also print a graphical representation of the calibration data. Also, the software has the capibility to print sensor calibration labels for direct attachment to the device under test.

The software will do data averaging of up to 10 calibration runs and give the standard deviation. Contact the factory for more information about the System IIA software.

RACK MOUNTING: The Model 1806 can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 190-499) or Rack Mount Adapters and Side Panels for Chassis Slides (P/N 138-606). A rack adapter kit P/N 1919 is available for mounting Models 1805B and 1807A or 1808A in the same rack-mount configuration.

MODEL 1807A RF TRANSFER STANDARD: The Model 1807A is a Thermistor Mount/Power Splitter combination (with test port) mounted in a rack mountable configuration. Used as a feedthrough standard for System IIA setup configurations, the Model 1807A can provide a precision power standard . Using the Model 1807A in conjunction with the 1805B allows the System IIA to determine the calibration factors of power meters and sensors (refer to Model 1807A data Sheet).

MODEL 1808A CALIBRATOR: The Model 1808A combines a feedthrough type power standard (Model 1109) with 0 to 129 dB programmable step attenuator in 1 dB steps to provide a precision power standard with highly repeatable RF signal level. Using the Model 1808A in conjunction with a power step from the 1805B allows the System IIA to perform highly accurate linearity measurements over a wide dynamic range (refer to Model 1808A data Sheet).

MODEL 1726 RF AMPLIFIER: The Model 1726 RF Amplifier when used in conjunction with a +10 dBm RF Source (Model 4372) can increase the output power so that the System IIA may be utilized up to a 10 mW level in the 0.01 to 18 GHz frequency range (refer to Model 1726 data Sheet).

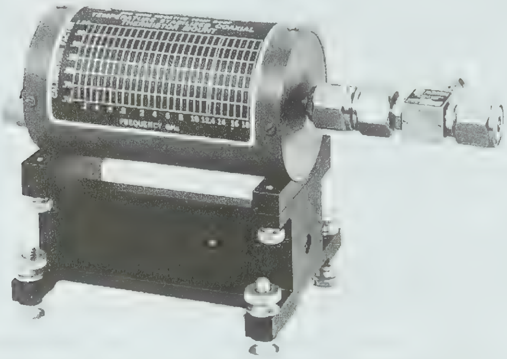
MODEL 8300 ATTENUATOR (LEVEL SET): The Model 8300 has the ability to store and hold calibration data. An enhanced user interface and digital display allow the operator to dial in the frequency, nominal attenuation setting and then display the actual calibrated value of attenuation, not just individual attenuator cell values. The GPIB bus (IEEE-488) interface gives both read and write access to the calibration data array, allowing for computer automated calibration setups (refer to Model 8300 data Sheet).

MODEL 446A IF SIGNAL SOURCE: The Model 446A provides a 2.5 Vdc reference voltage for use with the Lucas Weinschel System IIA Power Calibration System. This reference voltage allows a Digitial Voltmeter to be used on a more sensitive range in conjunction with the Lucas Weinschel 1110 and 1111 Thermistor Mounts and the Model 1806 Dual Type IV Bridge (refer to Model 446A data Sheet).

Model 1109 & 1110

0.01 to 18.0 GHz

COAXIAL POWER STANDARDS (THERMISTOR MOUNTS)



MODEL 1109 (FEEDTHROUGH MOUNT/SPLITTER)

MODEL 1110 (TERMINATING MOUNT)

NIST Calibrated or Traceable

Lucas Weinschel Models 1109 and 1110 Temperature Stabilized Coaxial Power Standards enable precise measurement of microwave power in the 0.01 to 18 GHz frequency range. Both units are extremely rugged, highly accurate, stable with time and temperature, and ideal for use as standards for the transfer of calibration factors to other standards and power meters. Each unit is supplied with calibration data traceable to NIST.

The Model 1109 is a Thermistor Mount/Power Splitter combination used as a feedthrough standard for the calibration of terminating power sensors such as bolometer mounts and power meters.

Both models are designed for use with dc self balancing bridges or controllers such as the Lucas Weinschel Model 1806 Dual Type IV Power Meter and the Model 1805B RF Power Level Control Unit. System configurations employing instruments of this extreme accuracy typically achieve results in the transfer of calibration factors normally found only in primary standards laboratories.

The Model 1110 is a terminating power standard capable of calibration directly by NIST, and is used for the calibration of feedthrough devices such as RF power meters, bolometer mount-coupler and bolometer mount-splitter assemblies, and in other configurations requiring direct measurement of RF power. Other features include:

* **10 μW to 25 milliwatts**
* **Low SWR and High Stability**
* **Thermally Stabilized**
* **Precision Dual-biased Thermistor Elements**

SPECIFICATIONS

FREQUENCY RANGE: 0.01 to 18.0 GHz

RF IMPEDANCE: 50 Ω nominal

THERMISTOR BIAS POWER: 30 ± 0.7 milliwatt with temperature control.

CONNECTORS: Type N connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. IEEE 7 mm precision connector TYPE II coupling mechanism mates with other GPC 7 connectors. Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

CALIBRATION: Individual calibrations traceable to NIST supplied at following frequencies (actual NIST calibrations available for additional cost):

0.01 to 0.10 GHz in 10 MHz increments
0.15 to 2.00 GHz in 50 MHz increments
2.10 to 4.00 GHz in 100 MHz increments
4.20 to 12.40 GHz in 200 MHz increments
12.75 to 18.0 GHz in 250 MHz increments

CALIBRATION FACTOR STABILITY: < 0.5 % per year

POWER DEPENDENCE OF CALIBRATION FACTOR: < 0.1% from 1 to 10 mW, negligible to maximum useful limit.

POWER MEASUREMENT RANGE: 10 μW to 25 mW

SPECIFICATIONS (Con't)

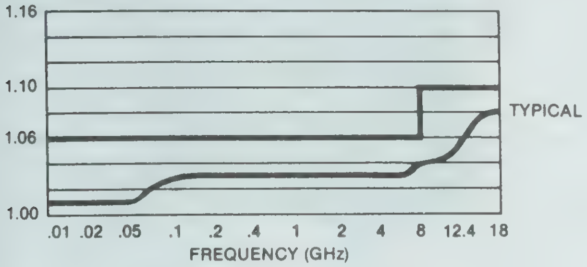
RESISTANCE AT BIAS: 200 Ω

RESISTANCE TEMPERATURE COEFFICIENT:

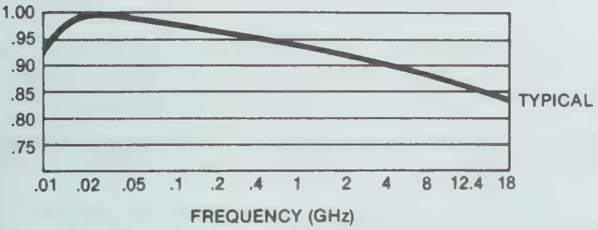
Negative

RESISTANCE POWER SENSITIVITY: ~ 13 Ω /mW

MODEL 1109 Sg: Individual calibration of magnitude and phase of the reflection coefficient is supplied for all NIST calibration frequencies. This data is supplied on floppy disc with hard copy backup.



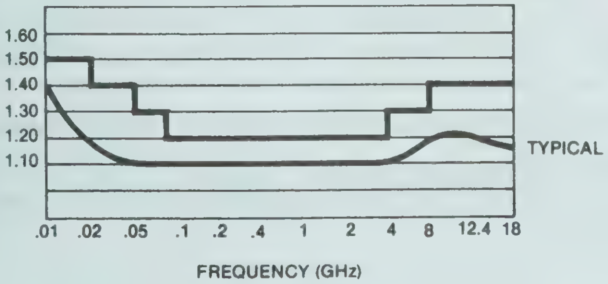
MODEL 1109 CALIBRATION FACTOR:



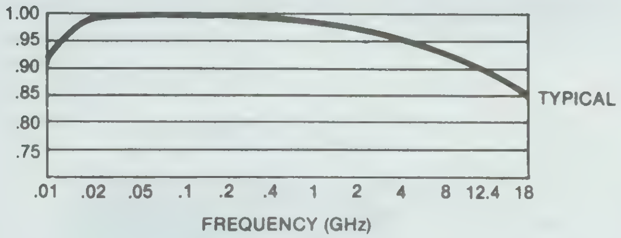
MODEL 1109 CALIBRATION FACTOR ACCURACY:

FREQUENCY (GHz)	RSS %
0.01 - 10 10 - 18	± 1.00 ± 1.10

MODEL 1110 SWR: Individual calibration of magnitude and phase of the reflection coefficient is supplied for all NIST calibration frequencies. This data is supplied on floppy disc with hard copy backup.



MODEL 1110 CALIBRATION FACTOR:



MODEL 1110 CALIBRATION FACTOR ACCURACY:

FREQUENCY (GHz)	RSS %
0.01 - 10 10 - 18	± 1.20 ± 1.30

TEMPERATURE RANGE:

Operating:	+12 °C to +40 °C
Non-Operating:	-55 °C to +75 °C

WEIGHT:

Model 1109:	Net: 1.5 kg (3 lbs, 4 oz)
Model 1110:	Net: 1.3 kg (2 lbs, 14 oz)

PHYSICAL DIMENSIONS:

Model 1109: 133 mm (5.25 in) high, 267 mm (10.5 in) long, 102 mm (4.03 in) wide.

Model 1110: 133 mm (5.25 in) high, 194 mm (7.6 in) long, 102 mm (4.03 in) wide.

ORDERING GUIDE

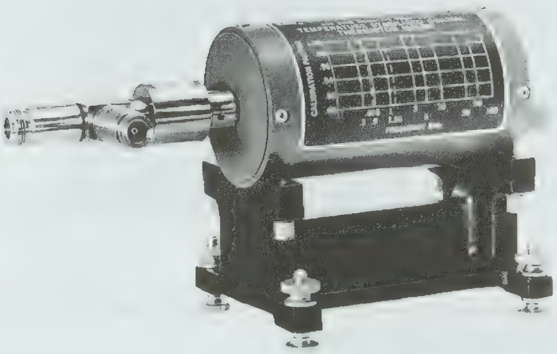
Model Number	Mount Connector Option
F1109	Type N (female)
F1110	Type N (female)
M1110	Type N (male)
1109WPC	GPC-7
1110WPC	GPC-7

NIST CALIBRATION: Calibration Factors only for the Model 1110 Terminating Mount can be supplied directly by the National Institute of Standards and Technology. Delivery of these units is determined by NIST calibration schedules which can add up to four months to factory availability. Contact factory for price and delivery of this service.

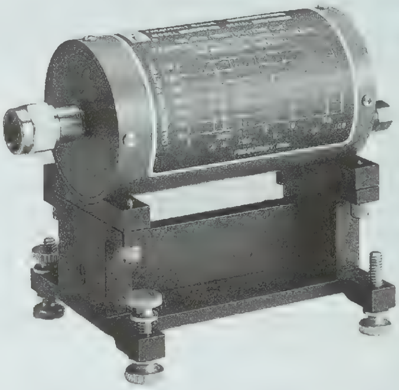
Models 1111 & 1116

0.1 to 100 MHz

COAXIAL POWER STANDARDS (THERMISTOR MOUNTS)



MODEL 1116 (FEEDTHROUGH MOUNT/SPLITTER)



MODEL 1111 (TERMINATING MOUNT)

NIST Calibrated or Traceable

Lucas Weinschel Models 1116 and 1111 Temperature Stabilized Coaxial Power Standards enable precise measurement of microwave power in the 0.1 to 100 MHz frequency range. Both units are extremely rugged, highly accurate, stable with time and temperature, and ideal for use as standards for the transfer of calibration factors to other standards and power meters. Each unit is supplied with calibration data traceable to NIST.

The Model 1116 is a Thermistor Mount/Power Splitter combination used as a feedthrough standard for the calibration of terminating power sensors such as bolometer mounts and power meters.

Both models are designed for use with dc self balancing bridges or controllers such as Lucas Weinschel Model 1806 Dual Type IV Power Meter and the Model 1805B RF Power Level Control Unit. System configurations employing instruments of this extreme accuracy typically achieve results in the transfer of calibration factors normally found only in primary standards laboratories.

The Model 1111 is a terminating power standard capable of calibration directly by NIST, and is used for the calibration of feedthrough devices such as RF power meters, bolometer mount-coupler and bolometer mount-splitter assemblies, and in other configurations requiring direct measurement of RF power. Other features include:

- **10 μW to 25 mW range**
- **Thermally stabilized**
- **Precision matched thermistor elements**
- **High stability**

SPECIFICATIONS

FREQUENCY RANGE: 0.1 to 100 MHz

RF IMPEDANCE: 50 Ω nominal

THERMISTOR BIAS POWER: 30 ± 0.7 milliwatt with temperature control.

CONNECTORS: Type N connector per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

CALIBRATION FACTOR STABILITY: < 0.5 % per year

POWER DEPENDENCE OF CALIBRATION FACTOR: < 0.1% from 1 to 10 mW, negligible to maximum useful limit.

SPECIFICATIONS (Con't)

POWER MEASUREMENT RANGE: 10 µW to 25 mW

RESISTANCE AT BIAS: 200 Ω

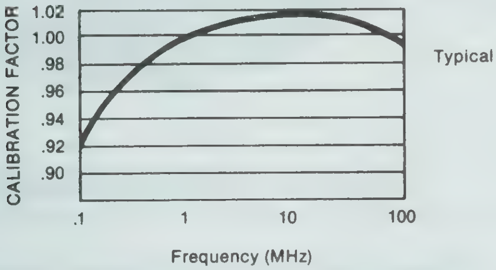
RESISTANCE TEMPERATURE COEFFICIENT:

Negative

RESISTANCE POWER SENSITIVITY: ~13 Ω/mW

MODEL 1116 CALIBRATION FACTOR: Individual calibration traceable to NIST supplied at following frequencies: 0.1, 0.3, 0.455, 1, 1.25, 3, 10 - 100 MHz in 10 MHz increments. This data is supplied on floppy disc with hard copy backup.

min. calibration factor: .90
max. ripple of calibration factor: 1%

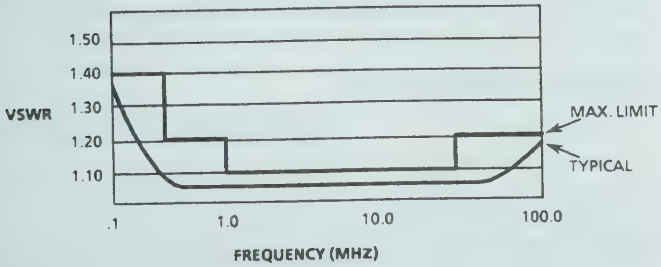


MODEL 1116 Sg: 1.06 maximum, Individual calibration of magnitude and phase of the reflection coefficient is supplied for all NIST calibration frequencies. This data is supplied on floppy disc with hard copy backup.

TYPICAL MODEL 1116 CALIBRATION FACTOR ACCURACY:

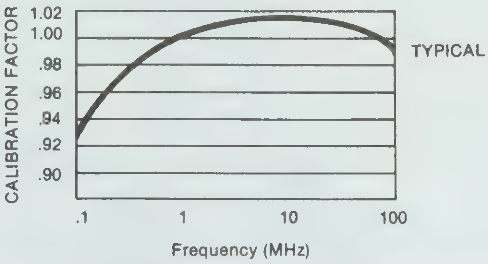
FREQUENCY (GHz)	RSS %
0.1 - 10.0	±0.80
10.0 - 100	±0.90

MODEL 1111 SWR: Individual calibration of magnitude and phase of the reflection coefficient is supplied for all NIST calibration frequencies. This data is supplied on floppy disc with hard copy backup.



MODEL 1111 CALIBRATION FACTOR: Individual calibration traceable to NIST supplied at following frequencies: 0.1, 0.3, 0.455, 1, 1.25, 3, 10-100 MHz in 10 MHz increments. This data is supplied on floppy disc with hard copy backup.

min. calibration factor: .90
max. ripple of calibration factor:: 1%



TYPICAL MODEL 1111 CALIBRATION FACTOR ACCURACY:

FREQUENCY (GHz)	RSS %
0.1 - 10.0	±0.80
10.0 - 100	±0.90

TEMPERATURE RANGE:

Operating:	+12 °C to +40 °C
Non-Operating:	-55 °C to +75 °C

WEIGHT:	Model 1116:	Net: 1.5 kg (3 lbs, 4 oz)
	Model 1111:	Net: 1.3 kg (2 lbs, 14 oz)

PHYSICAL DIMENSIONS:

Model 1116: 133 mm (5.25 in) high, 267 mm (10.5 in) long, 102 mm (4.03 in) wide.

Model 1111: 133 mm (5.25 in) high, 194 mm (7.6 in) long, 102 mm (4.03 in) wide.

ORDERING GUIDE

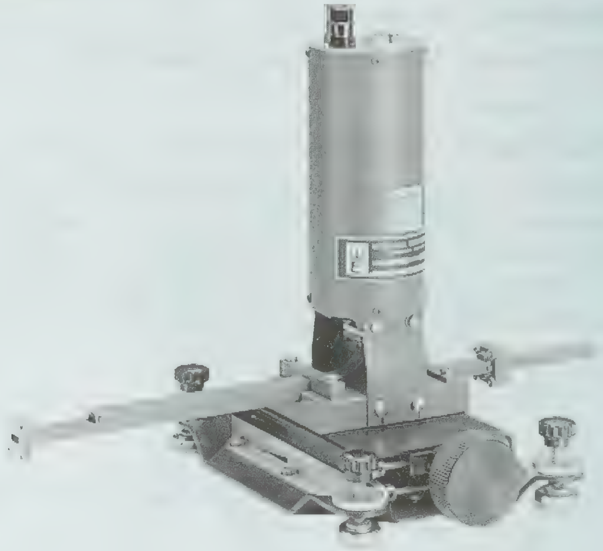
Model Number	Mount Connector Option
F1116	Type N (female)
M1111	Type N (male)

NIST CALIBRATION: Calibration Factors only for the Model 1111 Terminating Mount can be supplied directly by the National Institute of Standards and Technology. Delivery of these units is determined by NIST calibration schedules which can add up to four months to factory availability. Contact factory for price and delivery of this service.

Model 1107-7

RF POWER TRANSFER STANDARD (Terminating & Feedthrough)

18.0 to 26.5 GHz



NIST Calibrated or Traceable

WR-42 Waveguide

The Model 1107-7 Temperature Stabilized RF Power Standard enables precise measurement of microwave power in the 18 to 26.5 GHz frequency range. The unit is rugged, highly accurate and stable with time and temperature.

The Model 1107-7 consists of a 3 dB coupler with a thermistor mount on the coupler's side arm, and a removable termination on the coupler's main arm. With the termination removed, the 1107-7 becomes a feedthrough transfer standard, which is ideal for the transfer of calibration factors to terminating power standards or power sensors. With the termination attached the 1107-7 becomes a terminating transfer standard.

The 1107-7 power standard is supplied with calibration data traceable to NIST ("measure" calibration factor, K^1). Cal Factor data ("monitor" calibration factor, K^2) is also supplied for use when the unit is used as a feedthrough standard.

The 1107-7 is designed for use with a dc self balancing bridge such as the Lucas Weinschel Model 1806 Dual NIST Type IV Power Meter.

SPECIFICATIONS

FREQUENCY RANGE: 18 to 26.5 GHz

MAXIMUM EQUIVALENT SOURCE SWR: 1.20

RESISTANCE WHEN BIASED: 200 Ω

RESISTANCE TEMPERATURE COEFFICIENT:

Negative

DC BIAS POWER: 13.0 ± 2.0 mW

POWER MEASUREMENT RANGE: Up to 20 mW

CALIBRATION: Frequency(s): Individual calibration traceable to NIST supplied at 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 26.5 GHz. Calibration at NIST (K^1 only) and other frequencies are available at additional cost.

CALIBRATION FACTOR ACCURACY: Within limits stated by NIST, typically 1.0 - 1.5%.

CALIBRATION FACTOR STABILITY: Better than 0.5 % per year

CALIBRATION FACTOR POWER LEVEL DEPENDENCE: < 0.1% change from 1 to 10 mW, negligible to maximum useful limit.

CONNECTORS: Waveguide, WR-42 Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

TEMPERATURE RANGE:

Operating:	+12 °C to +40 °C
Non-Operating:	-55 °C to +75 °C

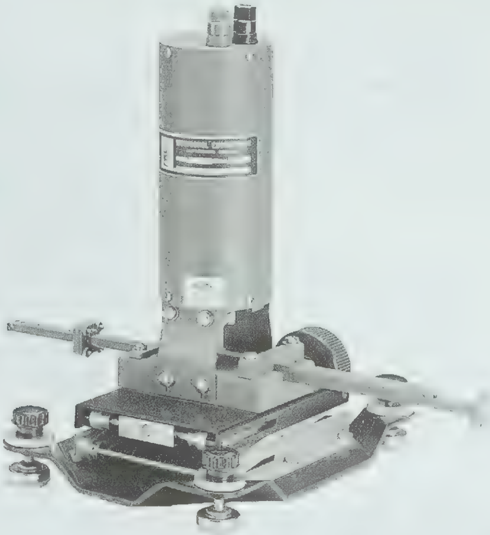
WEIGHT: Minimum net, 5.1 kg (11 lbs, 3 oz)

PHYSICAL DIMENSIONS: 285 mm (11.2 in) high, 391 mm (15.4 in) long, 239 mm (9.4 in) wide.

Model 1107-8

26.5 to 40 GHz

RF POWER TRANSFER STANDARD (Terminating & Feedthrough)



NIST Calibrated or Traceable

WR-28 Waveguide

The Model 1107-8 Temperature Stabilized RF Power Standard enables precise measurement of microwave power in the 26.5 to 40 GHz frequency range. The unit is rugged, highly accurate and stable with time and temperature.

The Model 1107-8 consists of a 3 dB coupler with a thermistor on the coupler's side arm, and a removable termination on the coupler's main arm. With the termination removed, the 1107-8 becomes a feedthrough transfer standard, which is ideal for the transfer of calibration factors to terminating power standards or power sensors. With the termination attached the 1107-8 becomes a terminating transfer standard.

The 1107-8 power standard is supplied with calibration data traceable to NIST ("measure" calibration factor, K^1). Cal Factor data ("monitor" calibration factor, K^2) is also supplied for use when the unit is used as a feedthrough standard.

The 1107-8 is designed for use with a dc self balancing bridge such as the Lucas Weinschel Model 1806 Dual NIST Type IV Power Meter.

SPECIFICATIONS

FREQUENCY RANGE: 26.5 to 40 GHz

MAXIMUM EQUIVALENT SOURCE SWR: 1.20

RESISTANCE WHEN BIASED: 200 Ω

TEMPERATURE COEFFICIENT OF RESISTANCE:

Negative

DC BIAS POWER: 13.0 ±2.0 mW

POWER MEASUREMENT RANGE: Up to 20 mW

CALIBRATION: Frequency(s): Individual calibration traceable to NIST supplied at 26.5, 30.0, 33.0, 36.5, 40.0 GHz. Calibration at NIST (K^1 only) and other frequencies are available at additional cost.

CALIBRATION FACTOR ACCURACY: Within limits stated by NIST, typically 1.0 - 1.5%.

CALIBRATION FACTOR STABILITY: Better than 0.5 % per year

CALIBRATION FACTOR POWER LEVEL DEPENDENCE: < 0.1% change from 1.0 to 10.0 mW, negligible to maximum useful limit.

CONNECTORS: Waveguide, WR-28. Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

TEMPERATURE RANGE:

Operating:	+12 °C to +40 °C
Non-Operating:	-55 °C to +75 °C

WEIGHT: Minimum net, 5.1 kg (11 lbs, 3 oz)

PHYSICAL DIMENSIONS: 285 mm (11.2 in) high, 391 mm (15.4 in) long, 239 mm (9.4 in) wide

Model 1805B

RF POWER LEVEL CONTROL UNIT

0.5 to 10 mW

IEEE - 488

Ensures Accurate Transfer of Calibration Factors

The 1805B RF Control Unit provides fast, reliable, and accurate leveled RF power when used in a closed-loop feedback arrangement. The unit provides automatic dc substitution at 0.5 mW and 1 mW to 10 mW in 1 mW steps using local or IEEE-488 bus control for easy and accurate transfer of calibration factors.

When used with the Lucas Weinschel Model 1109 RF power standard, the 1805B permits the accurate transfer of up to 109 calibration frequencies traceable to NIST from 0.01 to 18.0 GHz. The 1805B is also compatible with other Lucas Weinschel System IIA components including the 1116 and 1107 series RF Transfer Standards (refer to applicable data sheets for mount specifications).

An internal temperature controller raises and maintains the temperature of the mount chamber above ambient. This minimizes the effects of changes in ambient temperature for all Lucas Weinschel RF Transfer Standards.

The 1805B operates in a closed loop configuration for leveling the RF output of the Lucas Weinschel 4370 series RF signal generators and other compatible signal sources. They are controlled directly using an analog signal applied to a dc coupled AM input connector.

Ultra stable dc high precision metal film resistors provide dc power increments across a Lucas Weinschel patented self-balancing bridge. The front panel bridge meter provides visual indication that closed loop stabilization has been achieved and enables rapid system operation. Coarse and fine adjustments are provided to obtain a meter null reading with no RF applied.

In addition to the bridge balance and temperature indicator, the 1805B contains several operational and performance checks. A front panel Mount Error indicator blinks if the voltage across the mount is not within a specified range. This alerts the operator of a mount fault such as open or shorted leads, or improper mount temperature. DC supply voltages are monitored by PC B-mounted LEDs which illuminate with an active power supply.

A standby mode switch allows mount heater circuit operation to maintain mount temperature at all times. This ensures full performance capability and long term stability of the bolometer mount.

Other features of the 1805B are:

* **Automatic DC Level Control** - To within ± 0.1%, +1 μW, with an RF source variation of ± 3 dB and an ambient temperature range of +12 to +40 °C. The dc substitution level is held to an accuracy of +0.1%, +5 μW.

* **DC Substitution and Bias Supply** - Maximum accuracy is achieved by using DC power for both bias and substitution signals.

* **Quick Visual Indication of Operation and Performance** - The unit employs LEDs to inform the user of RF power on/off condition, ac power on/standby, mount error, and remote/listen functions. Easy-to-read meters are used to monitor temperature stability and bridge balance.

Model 1805B
RF Power Level Control Unit

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS

DC POWER SUBSTITUTION:

Level Range: 0.5, 1, through 10 mW

Accuracy (@ 30 ± 7 mW bias power): ± 0.1% + 5 µW

Bias Power Range: 29 - 31 mW, automatic with error indication for out-of-range balance condition.

Power Level Control Range: 3 - 23 dB minimum

Leveled RF Power (referenced to DC substituted power) Dynamic Range: ± 3 dB

Unbalanced Detector:

Sensitivity:	2 µW/division
Resolution:	0.2 µW

Leveler Loop Gain: 80 dB

TEMPERATURE CONTROLLER:

Bias Power Temperature Sensitivity: 2 µW/ °C per hour

Ambient Temperature Dynamic Range : +12 °C to +40 °C

Mount Warm-up Time: 2 hours nominal

Internal Temperature: +46 °C nominal

Loop Gain: 80 dB minimum

Open Loop Frequency Response: 0.1 Hz

Warm-up Drive (saturated): 8-10 V @ 200 mA minimum

Indicator: Voltmeter with marked operating range

OPERATING MODES:

Local: Manual front panel control of all unit functions.

Remote: IEEE-488 full function Bus Control RF ON/OFF and substituted DC output power levels (0.5 and 1 - 10 mW in 1 mW steps) using HP-85, Series 200 or any PC Compatible Controller.

TEMPERATURE RANGE:

Operating :	+10 to +40° C (+25 to 104° F)
Storage :	-40° to +75° C (-67° to +167° F)

CONNECTORS: Binding Post, standard 0.75" spacing for Banana plugs.

POWER REQUIREMENTS: 110/120/220/240 Vac ± 10%, 48 to 62 Hz, 40 Watts

WEIGHT: Net: 5.9 kg (13 lb)

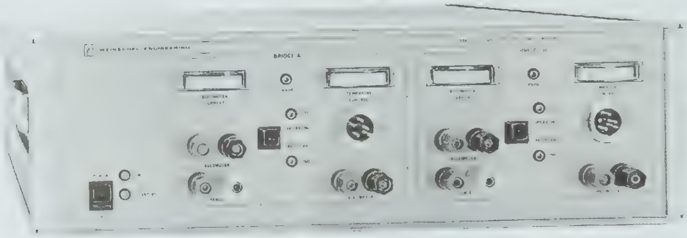
PHYSICAL DIMENSIONS: approximately 444.5 x 215.9 x 117 mm (17.5 x 8.5 x 7.0 in)

RACK MOUNTING: The Model 1805B is a half rack instrument that can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 1919). This kit allows the Model 1805B to be mounted with the Model 1807A, 1808A or another 1805B in the same rack-mount configuration.

Model 1806

10 μW to 30 mW

DUAL TYPE IV POWER METER



The Model 1806 Dual Type IV Power Meter is designed for use with bolometer elements to measure high frequency or microwave power. It also functions as a standard for the calibration of bolometer mounts, detectors, RF voltmeters, and for precision insertion loss measurements when used as part of the Lucas Weinschel System IIA Automatic Power Meter Calibration System.

The exclusive use of 100% dc substituted power eliminates the effect of ac components on the bridge circuit which has been shown to introduce a substantial error in the substituted power due to the short-term time constant of some bolometer elements. Substituted dc power levels ranging from 10 μW to 30 mW can be measured to within ± 0.003% which also makes this an ideal instrument for insertion loss measurements. Regardless of the application, all measurements can be made directly traceable to primary voltage and resistance standards.

The 1806 contains two Type IV Power Meters and two built-in temperature controllers for use with Lucas Weinschel Bolometer Mounts. The power meters are designed to bias either 100 or 200 ohm mounts and are thus compatible with System IIA, HP thermistor mounts, the Model 1110, 1111 and 1107 Series RF Transfer Standards (refer to applicable data sheets for mount specifications). Operating resistance for each power meter is selected by a front panel switch. Each power meter has a bolometer current meter and fault LED indicator which illuminates under any condition preventing loop balance. Terminals are provided for an external DVM, positive and negative bolometer, and voltage sense.

SPECIFICATIONS

RF (Substituted dc) POWER MEASUREMENT:

Typical Power Measurement Accuracy: ± 0.03% + 2 μW when used with Fluke Model 8505A or 8506A Voltmeters

Range: 10 μW to 25 mW
Substitution Bridge Accuracy: ± 0.003%

TEMPERATURE RANGE:

Operating : +10 to +40 °C (+25 to 104° F)
Storage : -40 to +75 °C (-67° to +167° F)

TEMPERATURE CONTROLLER:

Bias Power Temperature Sensitivity:	2 μW/ °C per hour
Ambient Temperature Dynamic Range :	+12 °C to +32 °C
Mount Warm-Up Time:	2 hours nominal
Internal Temperature:	+60 °C nominal
Loop Gain:	80 dB minimum
Open Loop Frequency Response:	0.1 Hz
Warm-Up Drive (saturated):	15 V @ 200 mA minimum
Indicator:	Voltmeter with marked operating range

CONNECTORS: Binding Post, standard 0.75" spacing for Banana plugs.

POWER REQUIREMENTS: 110/120/220/240 Vac ± 5 - 10%, 48 to 62 Hz, 25 Watts

WEIGHT: Net: 16 lbs. (7.26 kg)

PHYSICAL DIMENSIONS:

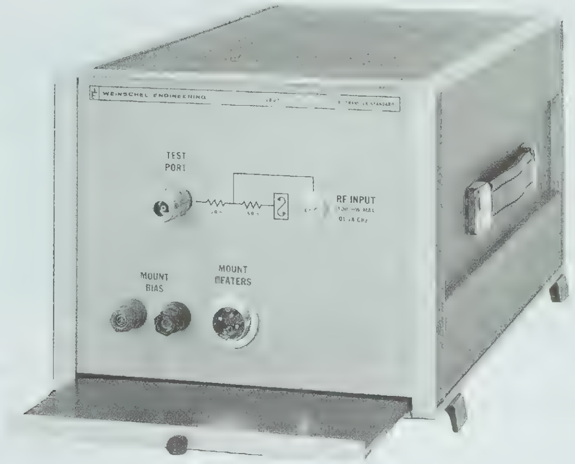
Height:	147.2 mm (5.80 in)
Width:	433.1 mm (18.35 in)
Depth:	466.1 mm (17.05 in)

RACK MOUNTING: The Model 1806 can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 138-606).

Model 1807A

0.01 to 18 GHz

RF TRANSFER STANDARD (Feed-through)



NIST Calibrated or Traceable

The Model 1807A is a Thermistor Mount/Power Splitter combination (with test port) used as a feedthrough standard for the calibration of terminating power sensors such as bolometer mounts and power meters.

The Model 1807A is extremely rugged, highly accurate, stable with time and temperature, and ideal for use as a standard for the transfer of calibration factors to other standards and power meters. Each unit is supplied with calibration data traceable to NIST.

This RF Transfer Standard is designed for use with all-DC self balancing bridges or controllers such as the Lucas Weinschel Model 1806 Dual NIST Type IV Power Meter and the Model 1805B RF Power Level Control Unit. System configurations employing instruments of this extreme accuracy typically achieve results in the transfer of calibration factors normally found only in primary standards laboratories (Refer to System IIA data sheet).

The Model 1807A RF Transfer Standard simplifies setup configurations requiring a precision power standard and a highly stable RF signal level all in one package. This package protects the individual components mounted within the 1807A from damage due to mishandling as can happen with other RF transfer standards. A pull-out shelf located in the bottom portion of the 1807A is provided for use as a work platform when calibrating power sensors and power meter mounts or for the transfer of calibration factors. Other features include:

- **10 μW to 25 mW**
- **Low SWR and High Stability**
- **Thermally Stabilized**
- **Precision Dual-biased Thermistor Elements**

Model 1807A
RF Transfer Standard

SPECIFICATIONS

FREQUENCY RANGE: 0.01 to 18.0 GHz

RF IMPEDANCE: 50 Ω nominal

THERMISTOR BIAS POWER: 40 ± 3.5 milliwatt at 22 ˚C ± 10 ˚C without temperature control; 30 ± 0.7 milliwatt with temperature control.

CALIBRATION FACTOR: Individual calibrations traceable to NIST supplied at following frequencies:

0.01, 0.05, 0.1, 0.5 GHz
1.0 to 2.0 GHz in 50 MHz increments
2.1 to 4.0 GHz in 100 MHz increments
4.2 to 12.4 GHz in 200 MHz increments
12.75 to 18 GHz in 250 MHz increments

CALIBRATION FACTOR STABILITY: < 0.5 % per year

POWER DEPENDENCE OF CALIBRATION FACTOR: < 0.1% from 1 to 10 mW, negligible to maximum useful limit.

POWER MEASUREMENT RANGE: 10 µW to 25 mW

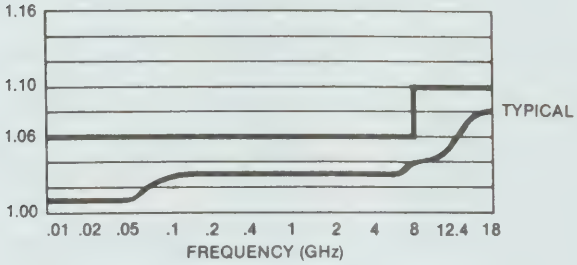
RESISTANCE AT BIAS: 200 Ω

RESISTANCE TEMPERATURE COEFFICIENT:

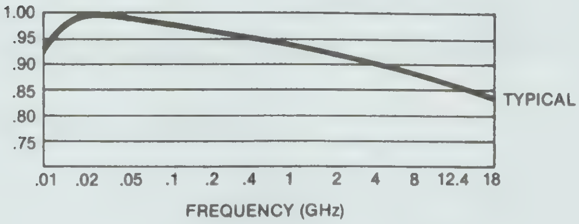
Negative

RESISTANCE POWER SENSITIVITY: ~ 13 Ω /mW

SWR (Sg): Individual calibration supplied at 2, 4, 8, 10, 12.4, 15, 18 GHz fixed frequencies. Calibration at NIST and other frequencies are available at additional cost.



CALIBRATION FACTOR:



CALIBRATION FACTOR ACCURACY:

FREQUENCY (GHz)	RSS
0.01 - 1	± 1.53
1 - 3	± 1.73
3 - 4	± 2.18
4 - 8	± 2.21
8 - 18	± 2.50

TEMPERATURE RANGE:

Operating:	+12 ˚C to +40 ˚C
Non-OPerating:	-55 ˚C to +75 ˚C

CONNECTORS: Type N and SMA connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. IEEE 7mm precision connector TYPE II coupling mechanism mates with other GPC 7 connectors. Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

POWER REQUIREMENTS: No power required.

WEIGHT: Net 5.69 kg (12 lbs., 8 1/2 oz.)

DIMENSIONS: approximately 444.5 x 215.9 x 117 mm (17.5 x 8.5 x 7.0 in)

ORDERING GUIDE

Model Number	Mount Connector Option
1807A	Type N (female)
1807A-WPC	GPC-7

RACK MOUNTING: The Model 1807A is a half rack instrument that can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 1919). This kit allows the Model 1807A to be mounted with the Model 1805B, 1808A or another 1807A in the same rack-mount configuration.

Model 1808A
CALIBRATOR

0.01 to 18 GHz

IEEE - 488

WEINSCHEL ENGINEERING
1808 CALIBRATOR
JUMPER
LISTEN
LEVELED OUTPUT
ATTENUATED OUTPUT
MOUNT BIAS
MOUNT HEATER
RF IN
ON
POWER

NIST Calibrated or Traceable

The 1808A provides a precision power standard with highly repeatable Level Set Attenuator. The Model 1808A is extremely rugged, highly accurate, stable with time and temperature, and ideal for use as a standard for the transfer of calibration factors to other standards and power meters. Each unit is supplied with calibration points traceable to NIST.

Model 1808 combines a feedthrough type power standard (Model F1109) with a highly repeatable 0 to 129 dB programmable step attenuator. By using the external jumper provided on the front panel of the 1808A, the signal from the thermistor mount/splitter combination is directed to the bus programmable 129 dB attenuator.

Stability is provided for the transfer standard test port that facilitates use of a torque wrench to ensure connector repeatability. A pull-out shelf, located in the bottom portion of the 1808, serves as a convenient work platform for calibrating power sensors and power meter mounts or for the transfer of calibration factors.

When used with a synthesized signal source (or sweep generator) and the 1805B RF Control Unit, the 1808A becomes an integral part of a precision calibration system. Aside from determining the calibration factor of power meters and RF power sensors, the 1808A is used to calibrate receivers, spectrum analyzers, sensitive power meters over a wide dynamic range. This allows these types of instruments to be used to make accurate high and low level power measurements traceable to NIST.

The Model 1808A can be used to verify calibration of attenuation measuring instruments such as the VM-4, VM-7, VM-24 and scalar network analyzers. Using the 0 to 129 dB programmable (level set) attenuator in conjunction with a power step from the 1805B, a highly accurate means for determining linearity measurements over a wide dynamic range (traceable to NIST) is provided.

SPECIFICATIONS

FREQUENCY RANGE: 0.01 to 18.0 GHz

RF IMPEDANCE: 50 Ω nominal

THERMISTOR BIAS POWER: 40 ± 3.5 milliwatt at 22 °C ± 10 °C without temperature control; 30 ± 0.7 milliwatt with temperature control.

CALIBRATION FACTOR: Individual calibrations traceable to NIST supplied at following frequencies:

0.01, 0.05, 0.1, 0.5 GHz
1.0 to 2.0 GHz in 50 MHz increments
2.1 to 4.0 GHz in 100 MHz increments
4.2 to 12.4 GHz in 200 MHz increments
12.75 to 18 GHz in 250 MHz increments

CALIBRATION FACTOR STABILITY: < 0.5 % per year

POWER DEPENDENCE OF CALIBRATION FACTOR: < 0.1% from 1 to 10 mW, negligible to maximum useful limit.

POWER MEASUREMENT RANGE: 10 μW to 25 mW

RESISTANCE AT BIAS: 200 Ω

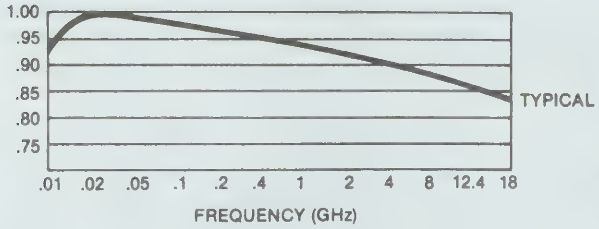
RESISTANCE TEMPERATURE COEFFICIENT:

Negative

RESISTANCE POWER SENSITIVITY: ~ 13 Ω /mW

SWR (Sg): Individual calibration supplied at 2, 4, 8, 10, 12.4, 15, 18 GHz fixed frequencies. Calibration at NIST and other frequencies are available at additional cost.

CALIBRATION FACTOR:



CALIBRATION FACTOR ACCURACY:

FREQUENCY (GHz)	RSS
0.01 - 1	± 1.53
1 - 3	± 1.73
3 - 4	± 2.18
4 - 8	± 2.21
8 - 18	± 2.50

OPERATING MODES: IEEE-488 full function Bus using HP-85, Series 200 or any PC Compatible Controller.

ATTENUATOR SPECIFICATIONS:

Nominal Impedance: 50 Ω

Frequency Range: dc to 18.0 GHz

Standard Incremental Attenuation/Steps:
0-129 dB in 1 dB steps

Incremental Insertion Loss:

0-9 dB ± 0.75 dB
0-60 dB ± 1.5 dB or 2% (whichever is greater)

Insertion Loss, Residual: 1 dB maximum

Maximum SWR: 1.6

Incremental Phase Shift: ~0.25 per dB x f(GHz)

Power Rating: 2 watts average, 200 watts peak. Maximum rated average power to 25 °C ambient temperature, derated to 1 watt @ 54 °C.

Repeatability: ± 0.05 dB each cell

Switching Method: dc gear motor

Switching Speed: 1 μsec typical, 1.25 μsec maximum any position to any other position.

TEMPERATURE RANGE:

Operating:	+12 °C to +40 °C
Non-OPerating:	-55 °C to +75 °C

CONNECTORS: Female Type N (OUTPUT) and Female SMA (INPUT) connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. Mount outputs are Binding Post, standard 0.75" spacing for Banana plugs.

POWER REQUIREMENTS: 115/230 Vac ± 10 - 20%, 45 to 450 Hz

WEIGHT: Net 5.69 kg (12 lbs, 8 1/2 oz)

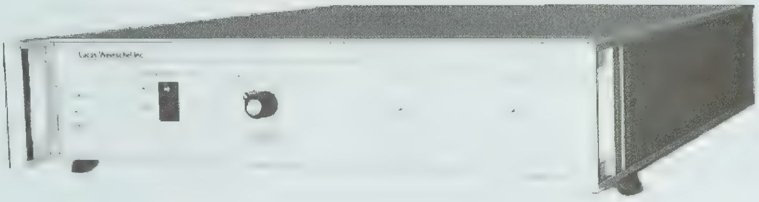
DIMENSIONS: approximately 444.5 x 215.9 x 117 mm (17.5 x 8.5 x 7.0 in)

RACK MOUNTING: The Model 1808A is a half rack instrument that can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the Rack Adapter Kit (P/N 1919). This kit allows the Model 1808A to be mounted with the Model 1805B, 1807A or another 1808A in the same rack-mount configuration.

Model 1726
RF AMPLIFIER

0.01 to 18.0 GHz

IEEE - 488



Precision Power Level of up to 100 milliwatts

The Model 1726 Amplifier Interface Unit is intended as an accessory for the Lucas Weinschel System IIA Automatic Power Meter Calibration System (Figure 1) or can be used with any other system requiring signal amplification in the 0.01 to 18 GHz frequency range. When used in conjunction with a +10 dBm RF Source (Model 4372) it increases the output power so that the System IIA may be utilized up to a 10 mW level.

The Model 1726 can be manually controlled or via the IEEE 488 bus. This unit contains four internal buffer amplifiers to cover the frequency range 0.01 - 18 GHz.

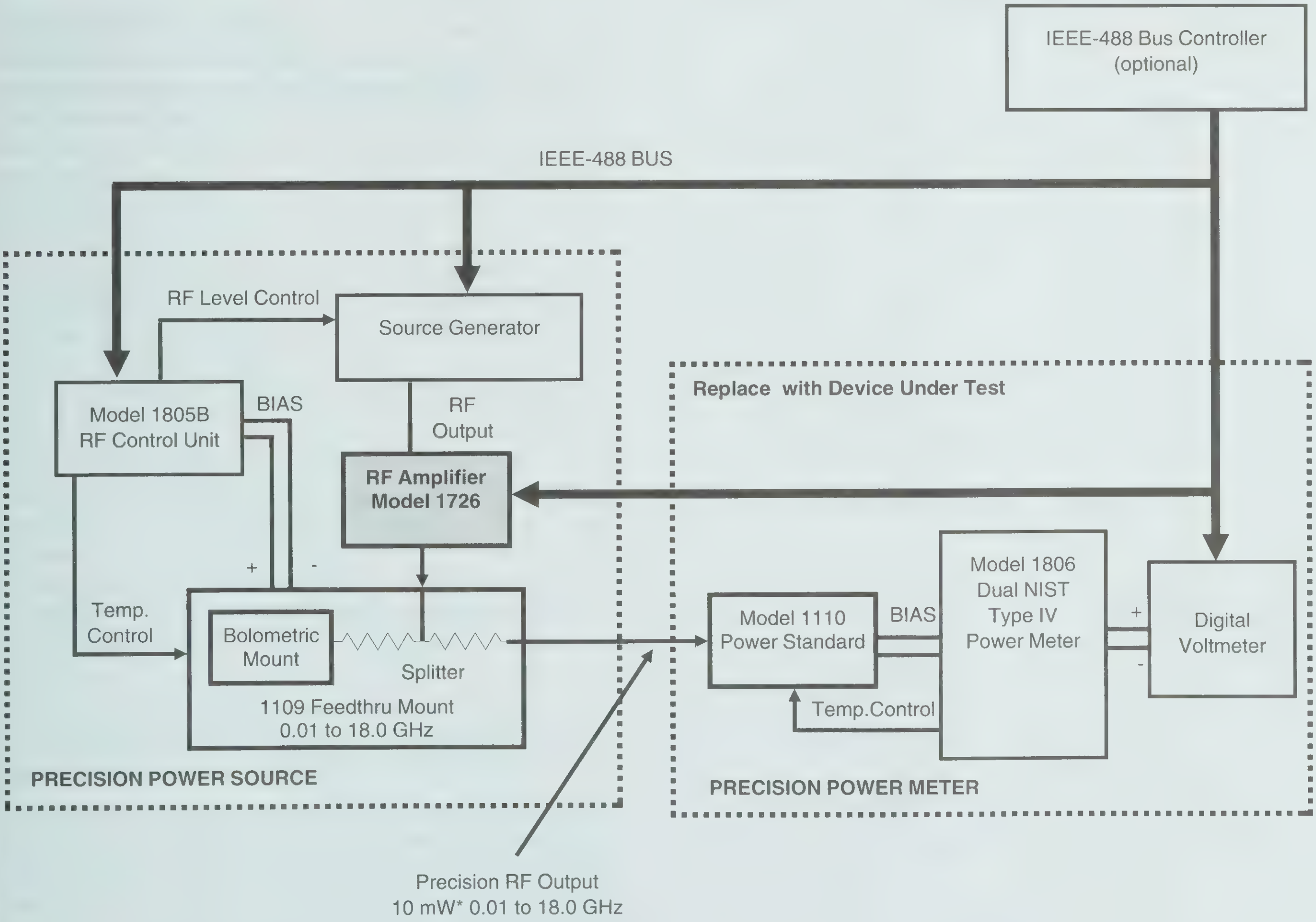

IEEE-488 Bus Controller (optional)
IEEE-488 BUS
RF Level Control
Source Generator
Model 1805B RF Control Unit
BIAS
RF Output
RF Amplifier Model 1726
+
-
Temp. Control
Bolometric Mount
Splitter
1109 Feedthru Mount 0.01 to 18.0 GHz
PRECISION POWER SOURCE
Replace with Device Under Test
Model 1110 Power Standard
BIAS
Model 1806 Dual NIST Type IV Power Meter
+
-
Digital Voltmeter
Temp.Control
PRECISION POWER METER
Precision RF Output
10 mW* 0.01 to 18.0 GHz

Figure 1. System IIA Configuration using Model 1726

Model 1726 RF Amplifier

SPECIFICATIONS

OPERATING FREQUENCY: 0.01 to 18 GHz

INPUT IMPEDANCE: 50 Ω nominal

OUTPUT POWER: +20 dBm typical (with +10 dBm input)

SWR (input and output): < 2.0

GAIN:

FREQUENCY (GHz)	GAIN (dB)
0.01 - 1	12
1 - 2	10
2 - 6	15
6 - 18	15

1 dB OUTPUT COMPRESSION POINT: +20 dBm

3rd ORDER INTERMODULATION INTERCEPT:

FREQUENCY (GHz)	GAIN (dB)
0.01 - 1	+35
1 - 2	+29
2 - 6	+29
6 - 18	+29

OPERATING MODES:

Local: Manual front panel control of all unit functions.

Remote: IEEE-488 full function Bus using HP-85, Series 200 or any PC Compatible Controller.

CONNECTORS: Female SMA connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors.

TEMPERATURE RANGE:

Operating :	+25 ± 5 °C (+77 ± 9° F)
Storage :	-55 to +75° C (-67 to +167° F)

POWER REQUIREMENTS: 120/240 Vac ± 10% 48 to 62 Hz

WEIGHT: Net: 9.82 Kg (21.6 lbs)

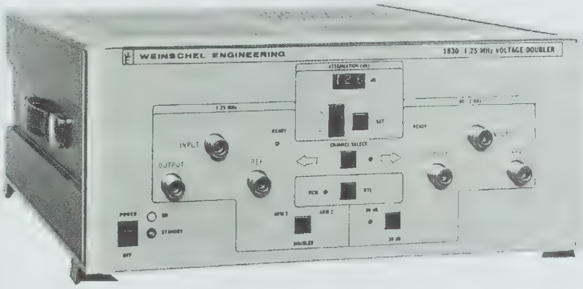
PHYSICAL DIMENSIONS: 88.9 mm (3.5 in) x 425 mm (16.8 in) x 520.7 mm (20.5 in)

RACK MOUNTING: The Model 1726 can be mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189 using the appropriate rack adapter kit.

Model 1830N
VOLTAGE DOUBLER

dc to 2.0 GHz

IEEE - 488



Microprocessor Controlled Precision Calibrator

The Model 1830 Voltage Doubler is a microprocessor controlled, precision calibrator specially designed to verify the calibration of the Lucas Weinschel VM-4, VM-7, VM-24, and other attenuation measuring instruments and receivers.

Operation at 1.25 MHz enables verification of the IF attenuation accuracy of the VM-4, and VM-24. The 2 GHz port enables the user to verify linearity of the VM-4. Additionally, the A/D converter contained in the VM-4 may be accurately checked by using the 1830N in a bypass scheme. The bypass arrangement produces precise changes in attenuation of 0.001 - 1.5 dB.

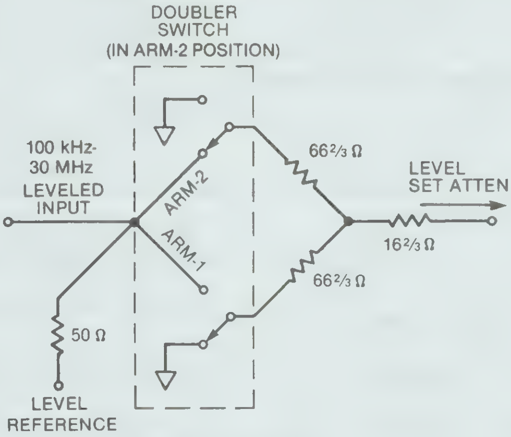
The Model 1830 is comprised of two channels. The first channel (dc to 1.25 usable to 30 MHz) contains a voltage doubler, in cascade with an 8-cell 3200 series, latching 127 dB binary attenuator. The voltage doubler provides a very accurate 2:1 change (6.0206 dB) at attenuation levels of 0 to 127 dB in 1 dB steps. Measurement repeatability is better than +0.0004 dB.

The voltage doubler (ARM1 and ARM2) is specially designed to sequentially toggle between the three different states (ARM1, ARM2, and combined). This increases longevity of the voltage doubler, ensures high repeatability, and provides a self-checking feature. A simplified schematic of the voltage doubler is shown in Figure 1.

Balance of the voltage doubler is easily verified during normal usage by selecting one arm and comparing the output reading to that obtained using the other arm.

The second channel (dc to 2 GHz) includes a highly repeatable (0.001 dB) 10 dB single step programmable attenuator in cascade with a 127 binary attenuator. Can be used to verify linearity of the VM-4 high-band and low-band operation. It can also be used to verify the linearity of 30 MHz receivers such as the VM-7. A simplified schematic of the 10 dB Step Attenuator is shown in Figure 2.

Both channels can be controlled locally via the front panel or remotely using a IEEE-488 system controller.



SWITCH POSITIONS

Both Arms Up = ARM-1
Both arms down = ARM-2
Both arms connected to input = combined (min. insertion loss)

Figure 1. 6.0206 dB Voltage Doubler

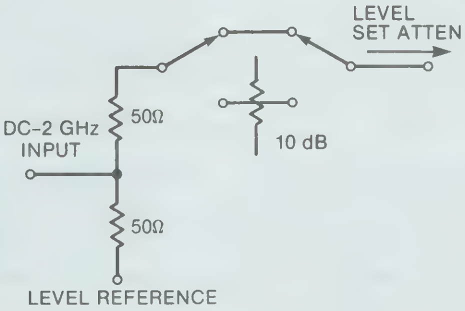


Figure 2. dc to 2 GHz, 10 dB Step Attenuator

U.S. Patent No. 4,495,556

Model 1830N Voltage Doubler

SPECIFICATIONS

SYSTEM CONFIGURATION:

Channel 1: Cascaded voltage doubler and level set 127 dB binary attenuator in 1 dB steps.

Channel 2: Cascaded 10 dB step attenuator, 10 dB fixed attenuator and level set 127 dB binary attenuator in 1 dB steps.

OPERATING FREQUENCY:

Channel 1:	Calibrated @ 1.25 MHz and 30 MHz
Channel 2:	dc to 2 GHz

INPUT LEVEL (Maximum): 27 dBm (1 watt)

IMPEDANCE (Nominal): 50 Ω

CHANNEL 1 (Voltage Doubler):

Nominal Value:	
@ 1.25 MHz:	6.0206 ± 0.01 dB
@ 30 MHz:	6.0206 ± 0.1 dB
Accuracy of Reported Value:	
@ 1.25 MHz:	± 0.0006 dB
@ 30 MHz:	± 0.001 dB
Repeatability:	
@ 1.25 MHz	± 0.0004 dB
@ 30 MHz	± 0.001 dB
Level Set Attenuator (0 to 127 dB):	
@ 1.25 MHz ± 0.2 dB or 1% (whichever is greater)	
Minimum Insertion Loss:	
OUTPUT Port:	-7 dB nominal
REF Port:	-6 dB nominal
(when OUTPUT and REF ports are terminated in 50 Ω)	

OPERATING MODES:

Local: Manual front panel control of all unit functions.
Remote: IEEE-488 full function Bus using HP-85, Series 200 or any PC Compatible Controller.

REFERENCE MATERIAL: "A Voltage Doubling Circuit for the Absolute Calibration of 30 MHz Attenuation Measurement Systems," P.I. Somlo. IEEE Transactions on Instrumentation and Measurement, Vol. IM-27 No. 1, March 1978, pgs 76-79.

CHANNEL 2 (10 dB Step Attenuator):

Nominal Value:	10 ± 0.3 dB
Repeatability at 2 Hz:	± 0.005 dB
Standard Deviation (100 steps):	± 0.001 dB
Level Set Attenuator (0 to 127 dB):	
± 0.3 dB or 3% (whichever is greater)	
Minimum Insertion Loss:	
OUTPUT Port:	-21 dB nominal
REF Port:	-6 dB nominal

CALIBRATION: Traceable to NIST @ 1.25 MHz. Calibration at other frequencies (100 kHz - 30 MHz) available upon request.

CONNECTORS: Female Type N connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors.

OPERATING TEMPERATURE:

Operating:	+12 °C to +32 °C
Non-Operating:	-55 °C to +75 °C

POWER REQUIREMENTS: 100/120/220/240 Vac +5, -10%, 50 VA maximum, 48 - 400 Hz

WEIGHT: Net, 13 kg (28 lbs)

PHYSICAL DIMENSIONS: 425.45 x 190.5 x 501.65 mm (16.75 x 19.75 x 7.5 in)

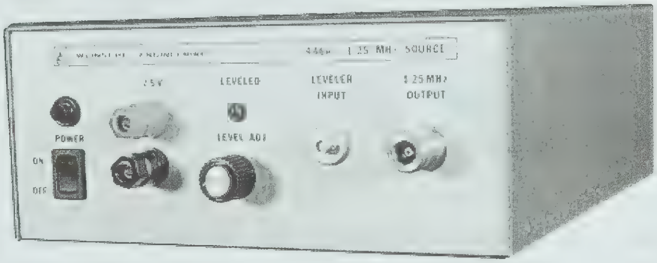
ACCESSORIES

MODEL 446A, 1.25 MHz SOURCE: The Model 446A is a 1.25 MHz Signal Source that can provide the Model 1830N with an unleveled signal of +13 dBm and an externally leveled signal that is adjustable over a 10 dB range.

Model 446A

IF SIGNAL SOURCE

1.25 MHz



Calibrated 1.25 MHz Test Source

The Model 446A is a 1.25 MHz signal source that provides an unleveled signal of +13 dBm with an externally leveled signal that is adjustable over a 10 dB range. This 1.25 MHz signal source can also provide a stable 2.5 Vdc source and 10 MHz reference signal.

The Model 446A serves as a test source for the verification of calibration of IF systems and devices designed to operate at a frequency of 1.25 MHz. Can be used as a 1.25 MHz test signal source when using the Lucas Weinschel Model 1830N Voltage Doubler to verify the linearity of the IF systems located in the Lucas Weinschel Models VM-4 and VM-24 Calibrator.

A 2.5 Vdc reference voltage is provided for use with the Lucas Weinschel System IIA Power Calibration System. The reference voltage allows a Digitial Voltmeter to be used on a more sensitive range in conjunction with the Lucas Weinschel 1110 and 1111 Thermistor Mounts and the Model 1606 Dual Type IV Bridge.

SPECIFICATIONS

OUTPUT FREQUENCY: 1.25 MHz ± 4 Hz

OUTPUT UNLEVELED: +13 dBm nominal

OUTPUT LEVELED: +6 dBm minimum after power splitter.

LEVELED RANGE: 10 dB

SPECTRAL PURITY: -50 dBc in 10 Hz bandwidth, 60 Hz from carrier

SHORT TERM STABILITY (Leveled): ± 0.002 dB (5 min. with ambient variation > 0.1 °C), typical.

REFERENCE OUTPUT: 10 MHz

REFERENCE VOLTAGE: 2.5 Vdc

REFERENCE VOLTAGE STABILITY: ± 0.0001 V (5 minimum with ambient temperature variation >0.1 °C)

CONNECTORS: Female Type N (1.25 MHz OUPUT) and Female SMA (Leveler INPUT) connectors per MIL-STD-348 interface dimensions mate nondestructively with MIL-C-39012 connectors. DC reference outputs are Binding Post, standard 0.75" spacing for Banana plugs.

TEMPERATURE RANGE:

Operating: +25 ± 5 °C
Non-Operating: -55 to +75 °C

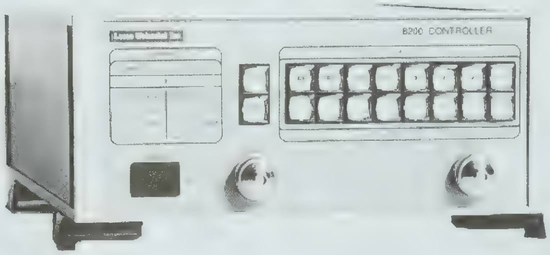
POWER REQUIREMENTS: 120/240 Vac ± 10%, 50-60 Hz

WEIGHT: Net, 3.6 kg (8 lbs)

PHYSICAL DIMENSIONS: 88.9 x 212.7 x 304.8 mm (3.5 x 8.375 x 12 in)

Model 8200
CONTROLLER

IEEE - 488



PLANAR CROWN™
CONNECTOR SYSTEM

Controls a Variety of Attenuators and Other RF Components

The Model 8200 Controller is capable of driving/controlling a variety of programmable attenuators, relays, electromechanical switches, or TTL compatible devices via either front panel or IEEE-488 GPIB operation. Installing the Lucas Weinschel Models 150, 151, 152, and 3200 series programmable attenuators into the Model 8200 will provide the user with a wide range of attenuation and frequency performance. The Model 8200 Controller can also provide the user with the following functions:

- Front-Panel and GPIB control of devices . . . functions as a GPIB to parallel data interface for device control, ATE systems, process-control applications, etc.
- 32 push-pull driver pin outputs arranged as 16 complimentary pairs.
- Each push-pull driver configurable via GPIB commands for mode of operation. . .

  - Active Low Output (SINK Mode)
  - Active High Output (SCE Mode)
  - Steady State or Pulsed-Mode Operation
  - Programmable Pulse Width
- Can control internally mounted, external, or a combination of devices . RF connections for internal devices can be either on the front or rear panel. External devices can be connected to rear panel 25 pin D connectors for control. +5, +12, and +24 Vdc outputs are available at the rear panel to supply power to user devices.
- Two opto-isolated input pins provide for general purpose use. They can be used to provide status and error indications back to user via GPIB Bus.
- Driver voltage is selectable for operation at +5 V, +12 V, or +24 V set via two internal slide switches in groups of eight driver pairs.
- Powerful GPIB command set. A macro-like configuration command allows the user to assign and functionally group from 1 to 16 of the output drivers under a user-defined eight character alphanumeric name, identifying pin numbers, driver type, attenuation values (if appropriate), pulse widths, etc. Once assigned, these 'virtual devices' may be accessed via bus commands without regard for any other devices that may be connected.
- Up to 16 'virtual devices' may be assigned at any one time. The configuration data is held in the non-volatile memory.
- Allows programming an attenuator device directly in terms of attenuation values, not in bit images. Automatically determines correct driver pin combinations to provide the requested value. The applications programmer no longer needs lookup tables, bit-field masks for device position, etc. EASY AND QUICK PROGRAM DEVELOPMENT!!!

PLANAR CROWN™CONNECTOR SYSTEM: The use of Lucas Weinschel PLANAR CROWN ™ connectors as part of the Model 8200 can provide user with easy exchange of connector types and eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick replacement of defective connectors. All crowns will mate nondestructively with connectors per MIL-STD-39012 (refer to PLANAR CROWN ™ data sheet for more details).

RACK MOUNTING: The Model 8200 can also be rack mounted as a single unit using Rack Mounting Kit (P/N 193-1018) or two Model 8200's can be mounted together using Rack Mounting Kit (P/N 193-1019). Using these kits will allow the Model 8200 to be mounted in any rack or cabinet that is designed according to EIA RS-310 or MIL-STD-189.

Model 8200 Controller

SPECIFICATIONS

OPERATING VOLTAGE: 90-130 Vac, 40-63 Hz
180-250 Vac, 40-63 Hz

ELECTRICAL DRIVER INTERFACE:

Output Driver Configurations: Totem-Pole Driver W/A Darlington Transistor Sink and a Psuedo-Darlington Source. Outputs have clamp diodes for inductive transient suppression.

Selectable Driver Voltages, V_{SS}: +5, +12, or +24 V dc (± 20 %)

dc Power Output: +5, +12, or +24 V dc @ 1A continuous/2.5 A peak

NOTE: Total combined dc power dissipation of all internal and external devices must not exceed 30 W in continuous operation.

Input Status Pins: Active state requires current sink to ground. The input pin will provide approximatey 10 mA of current at a Max voltage of 1.0 V.

Driver Output Voltages:

High Level Voltage, V_{OH} ($I_O = -0.5$ A): V_{SS} -1.5 V (Min)
($I_O = -1$mA): V_{SS} -1.1 V (Typ)

Low Level Voltage, V_{OL} ($I_O = 0.5$ A): 1.4 V (Max)
($I_O = 1$mA): 0.7 V (Typ)

Driver Output Current:

Peak Output Current, I_{pk}: ±2 A
(Nonrepetitive, Pulse Width ≤10 msec)

Continuous Output Current, I_O: ±1 A

Continuous Total Dissipation at (or below) 25 °C ambient temperature for drivers grouped as follows:

Group 1:	Drivers 1-4	2 W
Group 2:	Drivers 5-8	2 W
Group 3:	Drivers 9-12	2 W
Group 4:	Drivers 13-16	2 W

TEMPERATURE RANGE:

Operating 0 °C to +50 °C (+32 °F to 104 °F)
Storage -40 °C to +75 °C (-40 °F to +167 °F)

WEIGHT: Approximately 3.2 kg (7 lbs)

PHYSICAL DIMENSIONS: 88.9 mm (3.5 in) high x 232.7 mm (8.375 in), Width x 330.3 mm (13 in) Depth

ORDERING GUIDE

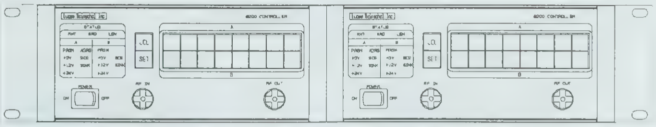
When ordering the Model 8200 Controller please specify the following:

- Quantity of basic Model 8200 Controllers.
- Attenuator model number and quantity desired (attenuators and kits are additional cost).
- If internal attenuator mounting is desired, select the appropriate installation kit from list below (Factory installation of these kits available).
- Type of connector and location front or rear panel. If Planar Crown™ connector system is desired, see configurations for model number and type (Crowns provided at additional cost).
- Ask about custom cabling for devices that will be controlled externally.
- If rack mounting is required select the appropriate kit listed below.

INSTALLATION KITS:

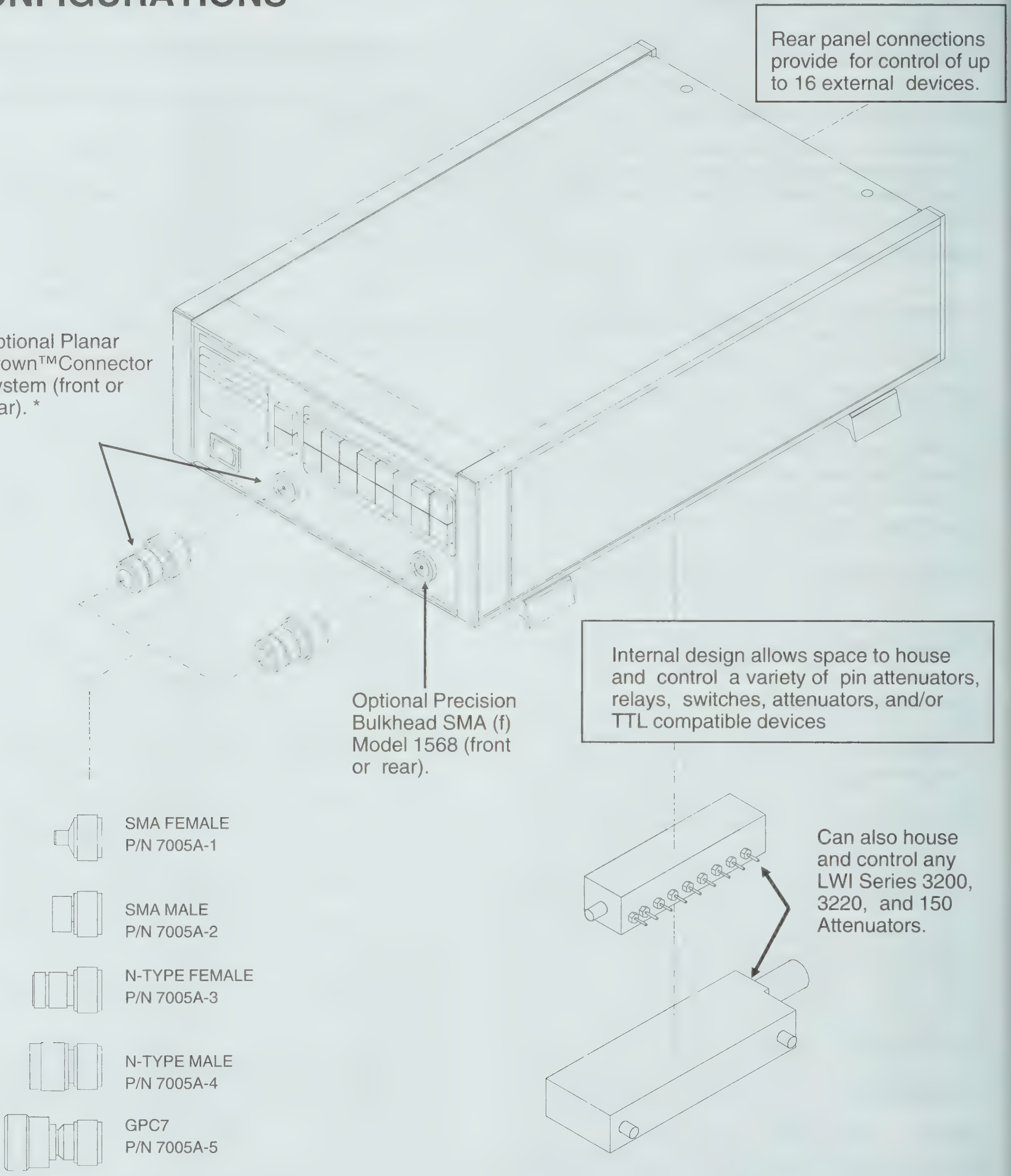
Part No.	Description
193-1012	Mounting Kit, 150 Series Attenuator (1)
193-1013	Mounting Kit, 150 Series Attenuator (2)
193-1014	Mounting Kit, 3200 Series Attenuator (1)
193-1015	Mounting Kit, 3200 Series Attenuator (2)
193-1016	Mounting Kit, 3220 Series Attenuator (1)
193-1017	Mounting Kit, 3220 Series Attenuator (2)
193-1018*	Rack Mounting Kit, Single 8200 (with 1/2 rack panel)
193-1019*	Rack Mounting Kit, Double 8200

* Kit fits any rack per EIA RS-310 or MIL-STD-189



Typical Dual (Model 8200) Rack Mounting

CONFIGURATIONS



Rear panel connections provide for control of up to 16 external devices.

Optional Planar Crown™Connector System (front or rear). *

Optional Precision Bulkhead SMA (f) Model 1568 (front or rear).

Internal design allows space to house and control a variety of pin attenuators, relays, switches, attenuators, and/or TTL compatible devices

Can also house and control any LWI Series 3200, 3220, and 150 Attenuators.

SMA FEMALE
P/N 7005A-1

SMA MALE
P/N 7005A-2

N-TYPE FEMALE
P/N 7005A-3

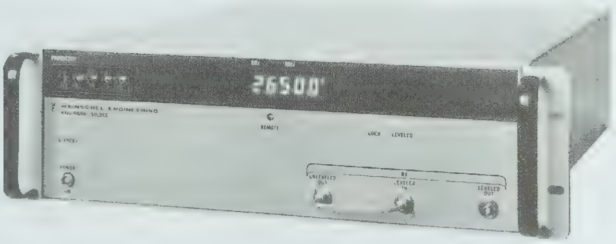
N-TYPE MALE
P/N 7005A-4

GPC7
P/N 7005A-5

* Note: Other types of crowns available.

Models 4370 & 4372 0.01 to 18.0 GHz
Models 4371 & 4373 0.01 to 26.5 GHz
SYNTHESIZED SIGNAL SOURCES

IEEE - 488



Four Models to choose from! Each is a digitally controlled, synthesized signal source. Models 4371 and 4373 provide precise, highly stable frequency steps in increments of 1 MHz from .01 to 26.5 GHz at +5 dBm and +10 dBm (leveled), respectively. Models 4370 and 4372 provide +5 dBm and +10 dBm (leveled) respectively from 0.01 to 18 GHz. Unleveled power for all models is substantially higher. YIG oscillators and solid state switching provide a choice of leveled RF power or maximum (unleveled) output power throughout the entire frequency range.

A microprocessor controlled two-loop synthesis technique ensures a spectrally pure signal source. All frequencies are generated directly by fundamental YIG oscillators or by mixing. Multipliers are not used for the higher frequency bands. Low frequency bands are derived by down conversion mixing. Phase-lock loop and leveling circuits within each band ensure precise frequency setting and amplitude control. In the local mode, output frequency is quickly and accurately set by thumbwheel switches.

The 4370 series is compatible with Lucas Weinschel Models VM-4, VM-7, 8852, 8850, VM-24 and System IIA. These units are manufactured exclusively for Lucas Weinschel by Gigatronics Inc.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE:

Models 4370, 4372:	0.01 to 18 .0 GHz
Models 4371, 4373:	0.01 to 26.5 GHz

MAXIMUM INPUT LEVEL:

Models 4370, 4371:	+5 dBm
Models 4372, 4373:	+10 dBm

RESOLUTION: 1 MHz

ACCURACY: Same as Time Base

TIME BASE (Internal): 10 MHz, < 1 x 10-^{6}/year

TIME BASE (Output): Buffered 10 MHz, 1 V RMS into 50 ohms from internal or external time base 0.5 to 5 p-p overrides internal time base

SPECTRAL PURITY:

Harmonics/Subharmonics:	<-20 dBc 0.01 to 0.05 GHz <-55 dBc 0.05 to 26.5 GHz
Nonharmonics:	<-55 dBc 0.05 to 26.5 GHz

OUTPUT LEVEL:

Models 4370, 4371: +5 dBm leveled @ 25 ˚C ± 10 ˚C with internal leveling +8 dBm available for extenal use.

Models 4372, 4373: +10 dBm leveled @ 25 ˚C ± 10 ˚C with internal leveling +8 dBm available for external use.

FLATNESS:

± 1 dB from 0.01 to 18 GHz @ 25 ˚C ± 10 ˚C
± 2 dB from 18 to 26.5 GHz @ 25 ˚C ± 10 ˚C

DISPLAY: Frequency, 5 digits

REMOTE INTERFACE: IEEE-STD-488 STD-1978 Set or Read Frequency

ENVIRONMENTAL: Complies with MIL-T-28800B, Type III, Class 5, Style E

OPERATING TEMPERATURE: 0 ˚C to 50 ˚C

WARM-UP TIME: 20 minutes, maximum

INPUT POWER REQUIRMENTS: 100, 120, 220, 240 Vac ± 10% @ 50 to 400 Hz

WEIGHT: NET: 29.5 kg (65 lbs)

PHYSICAL DIMENSIONS:

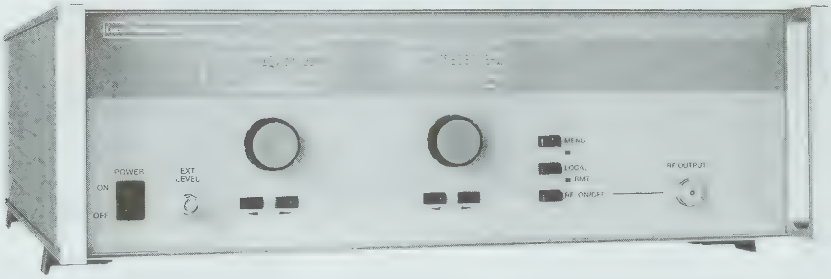
Height:	133.3 mm (5.21 in)
Width:	425.0 mm (16.75 in)
Depth:	609.0 (24.0 in)

Lucas Aerospace
Communications & Electronics

New Product

Model 4380 0.01 to 20.0 GHz
Model 4381 2.0 to 20.0 GHz
SYNTHESIZED CW SIGNAL SOURCES

IEEE - 488



Accurate, Stable, Inexpensive

PLANAR CROWN™ CONNECTOR SYSTEM

The Lucas Weinschel Model 4380 and Model 4381 Synthesized CW Signal Sourcesare the result of over 35 years experience in the design and manufacture of RF and microwave signal sources and sweepers. These new Synthesized CW Signal Sources fill the need for a low cost source of stable CW power. Whether the need is for production test or calibration laboratory, the combination of low phase noise and +10 dBm levelled output over the entire band is hard to beat. Couple this with 1 KHz resolution, internal and external levelling, manual or remote IEEE-488 bus operation and you have all the elements necessary for most manual or ATE measurement systems.

Why pay for functions that don't contribute to performance in dedicated applications? Focusing the design effort on CW operation only has yielded a lower cost instrument well suited to measurement systems in calibration laboratories, on the production floor, and in other application specific areas. Models 4380 and 4381 provide users with many benefits such as:

* Improved system performance at lower cost.

* Designed for compatibility with all Lucas Weinschel measurement systems.

Other features include:

* **Modular Design**.

* **System Capability** - The +10 dBm output provides clean, accurate signals for ATE applications requiring low phase noise, broadband frequency coverage, low spurious signals, and full IEEE-488 programmability.

* **10 MHz REF Input/Output** - This instrument will either accept or provide a 10 MHz reference signal for system operation.

* **Rack Mounting** - This instrument can be stacked easily with other Lucas Weinschel instruments or mounted in any cabinet or rack designed according to MIL-STD-189 or EIA RS-310 using the appropriate rack mounting kit.

* **Digital Sweep Functions** - The Models 4380 and 4381 allow the user to define and perform frequency sweeps such as:

- ➡ **Step Sweep** - This function allows a manually incremented sweep from a start frequency to a stop frequency in user defined step sizes.
- ➡ **Single Sweep** - This function provides a single sweep from one frequency to another frequency in user defined step sizes.
- ➡ **Auto Sweep** - This function provides a continuously repeated sweep from one frequency to another frequency in user defined step sizes.

* **Superior Spectral Purity** - These Synthesizers have a low SSB phase noise specification of <-74 dBc/Hz at 10 kHz offset from the carrier in the 10 to 20 GHz band. Nonharmonic spurious signals are specified at -50 dBc with harmonics of <-30 dBc to 2 GHz and <-40 dBc to 20 GHz and subharmonics of <-40 dBc across the entire band.

PLANAR CROWN™CONNECTOR SYSTEM: The use of Lucas Weinschel PLANAR CROWN ™ connectors as part of the Model 4380 and 4381 can provide the user with an easy exchange of connector types and eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick replacement of defective connectors. All crowns will mate nondestructively with connectors per MIL-STD-39012 (refer to PLANAR CROWN ™ data sheet for more details).

Models 4380 & 4381
Synthesized CW Signal Sources

Lucas Aerospace
Communications & Electronics

SPECIFICATIONS:

FREQUENCY RANGE: Model 4380 0.01 to 20 GHz
Model 4381 2 to 20 GHz

FREQUENCY RESOLUTION: 1 KHz

FREQUENCY SWITCHING TIME: 50 msec maximum any two frequencies to be within 1 KHz of final frequency. <10 msec for frequency steps of <20 MHz.

TIME BASE:

Standard Time Base:	Internal: External:	10 MHz 10 MHz
Temperature Stability:	1 x 10^{-6} 0-50 ^{o}C	
Aging Rate:	5 x 10^{-7} per day average 1 x 10^{-6} per year	

SPECTRAL PURITY (GUARANTEED):

Single Sideband phase noise $\mathcal{L}$(f) dBc/Hz:

Band (GHz)	$\mathcal{L}$ (f)				
	30	100	1K	10K	100K
0.01-2	-57	-69	-77	-83	-103
2-4	-60	-72	-80	-86	-106
4-10	-54	-66	-74	-80	-100
10-20	-48	-60	-68	-74	-94

Harmonics:	0.01-2 GHz 2-20 GHz	<-30 dBc <-40 dBc
Sub-harmonics:		<-40 dBc
Non-harmonic spurious:		<-50 dBc

Power line spurious dBc:

Band	<300	>300
0.01-2	-40	-50
2-4	-46	-56
4-10	-40	-50
10-20	-34	-44

NOTE: Specifications subject to change at any time.

OUTPUT POWER:

Maximum Leveled Output:	>+10 dBm*
Resolution:	0.01 dB
Level Vernier Range:	>10 dB
Level Settling Time:	<10 msec
Flatness and Accuracy:	± 1 dB*
Source Leveling:	Internal/External
External:	Crystal, Thermistor, Power Meter
RF OFF:	Carrier reduced to <-140 dBm at the output connector.

* Specification based on 15-35 °C Temperature Range

OPERATING MODES:

Local: Manual front panel control of all unit functions.
Remote: Compatible with IEEE-488 STD-1987.1 IEEE-488 Bus control of all functions except ac power.

OPERATING TEMPERATURE: 0 °C to 50 °C

INPUT POWER: 100, 120, 220, 240 Vac ± 10%
48-66 Hz, 300 VA maximum

WEIGHT: 22.68 Kg (50 lbs) maximum

PHYSICAL DIMENSIONS:

Height:	133.3 mm (5.21 in)
Width:	425.0 mm (16.75 in)
Depth:	609.0 (24.0 in)

OPTIONS

Step Attenuator Option (-01*): This option adds a Level Setting Attenuator with a range of 0 to 90 dB in 10 dB steps. The maximum leveled output of the Models 4380 and 4381 with the attenuator installed is +10 dBm from 0.01-18 GHz and +8 dBm from 18-20 GHz over the 0 to 90 dB range. To order this option add -01 to the model number (4380 or 4381).

High Stability Time Base (-02*): This option replaces the standard (1 x 10^{-6}, 0-50 °C) 10 MHz reference oscillator with a higher stability oscillator which has a stability of ±5 x 10^{-10} over the 0-50 °C temperature range with an aging rate of 1 x 10^{-10} per day. To order this option add -02 to the model number (4380 or 4381).

* If both (-01 & -02) options are desired, simply add -03 to the model number (4380 or 4381).

Model 1577 1 to 18 GHz
Model 1578 0.01 to 1 GHz
SHIELDED DOUBLE-BALANCED MIXERS

Rugged SMA & Type N Connectors

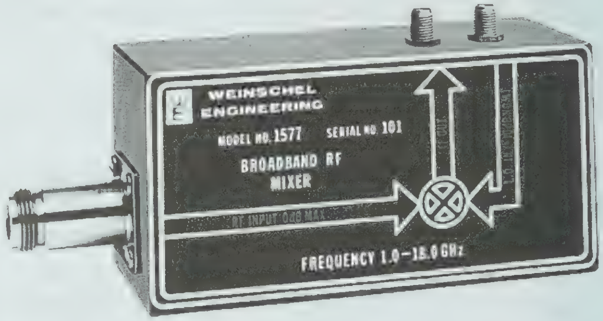
FEATURES

* **BROADBAND** - 0.01 - 18 GHz in 2 units;

- Model 1577 from 1 - 18 GHz
- Model 1578 from 0.01 to 1.0 GHz

* **HIGHLY SHIELDED**

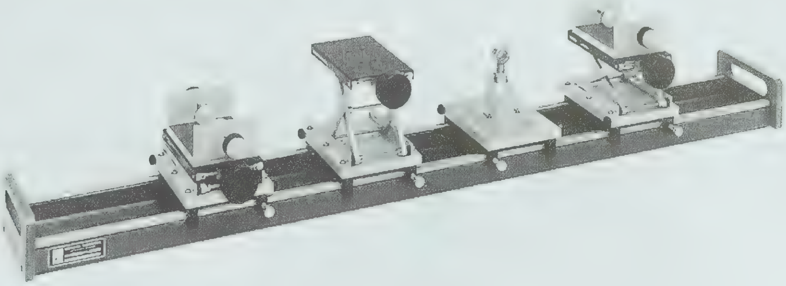
* **RUGGED CONSTRUCTION** - High strength case and input connector.



SPECIFICATIONS:

MODEL NUMBER	Model 1577	Model 1578
FREQUENCY RANGE	1-18 GHz	0.01-1 GHz
SWR RF INPUT LO INPUT	4.0 maximum 4.0 maximum	4.0 maximum 4.0 maximum
CONVERSION LOSS	11 dB maximum @ + 10 dBm LO Power	8 dB maximum @ + 10 dBm LO Power
RF TO LO ISOLATION (20 dB Typical)	15 dB minimum	25 dB minimum
LO INPUT POWER	+3 to +13 dBm	+3 to +13 dBm
RF INPUT POWER	0 dBm for 1 dB Compression	0 dBm for 1 dB Compression
RF INPUT CONNECTOR	N Female	N Female
IF AND LO CONNECTORS	SMA Female	SMA Female
WEIGHT (Net)	1.14 kg (2.5 lbs)	1.14 kg (2.5 lbs)
DIMENSIONS	117 mm (4.6 in) long, 61 mm (2.4 in) wide, 43 mm (1.7 in) high,	117 mm (4.6 in) long, 61 mm (2.4 in) wide, 43 mm (1.7 in) high,

Model MB-4
PRECISION MEASUREMENT BENCH



Improves Measurement Repeatabliity

FEATURES

- Minimizes Connector Alignment Problems
- Reduces Connector Stress
- Speeds Measurement Time and Set-up
- Solid, Damage Resistant Device Positioning--ideal For Any Set-up Requiring Stable and precise alignment

MECHANICAL

- Heavy duty aluminum U-Channel base
- Durable stainless steel support rails
- Fully adjustable scissor-jack support units
- Adjustable clamping support unit for 5/8" diameter devices
- Fully removable support units for configuration versatility
- Shock absorbing rubber feet for cushioned support
- Locking nylon slides for solid positioning of support units

The Model MB-4 consists of the following assemblies:

- Main base and track unit
- Adjustable scissor-jack support units (three)
- Adjustable 5/8" device support unit

The Model MB-4 Measurement Bench is an ancillary assembly for use in precision measurement set-ups. Originally developed for use with the Lucas Weinschel Model VM-4A Attenuator and Signal Generator Calibrator, the built-in versatility of the Model MB-4 makes it an ideal device for any set-up requiring stable and precise alignment.

MAIN BASE AND TRACK UNIT: The Main Base is constructed of U-Channel Aluminum with end support cutouts for easy carrying. Heavy duty rubber feet support the unit while absorbing vibrations and preventing shock transmission to the mounted components. The Track Unit consists of two polished stainless steel rails which facilitate lateral positioning of the Support Units.

ADJUSTABLE SCISSOR-JACK SUPPORT UNITS: The three Scissor-Jack Support Units are mounted on the Track Unit with nylon slides for easy and silent positioning. Each unit contains a single slide locking screw to positively secure the unit at the selected lateral position. A knob-activated adjustment mechanism allows vertical positioning of the support plate to a maximum of 8-1/2". Two of the support units also contain dual threaded clamp assemblies with nylon socket style leveling pads for solid, damage resistant, device positioning. The units are quickly removable by simply loosening the slide locking screw.

ADJUSTABLE 5/8" DIAMETER DEVICE SUPPORT: The 5/8" Device Support Unit is mounted on the Track Unit with nylon slides and contains a slide locking screw to secure the unit in the selected lateral position. A 5/8" diameter device (e.g., standard Type N female connector body, such as Lucas Weinschel Model 1870A or 1872A Power Splitter used with the VM-4A System) is securely held by means of a split ring clamp assembly. The clamp support is mounted in a tube to allow vertical positioning of the ring. A single locking screw maintains the clamp assembly in the selected vertical position.

WEIGHT: Approximate 14.5 kg (32 lbs)

PHYSICAL DIMENSIONS: (Stands retracted) 1,244.6 mm (49 in) long; 152.4 mm (6 in) wide; 76.2 mm (3 in) high.

Models 1583 & 1585

ACCESSORY CABLES

Lucas Weinschel Series 1583 and 1585 Accessory Cables can complete the assembly of the various configurations for Lucas Weinschel systems. The RF cables are flexible, low loss cables which are specially shielded to maintain the lowest leakage levels consistent with flexible cable design. Order the Model 1583 and 1585 Series Cables as follows.

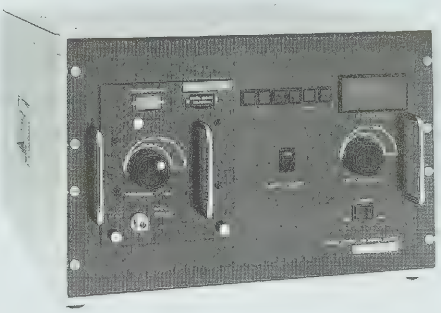
Model 1583, IEEE-488 GPIB Bus Cables

MODEL#	NOMENCLATURE	LENGTH
1583-3	IEEE Interface Cable	1 meter
1583-6	IEEE Interface Cable	2 meters
1583-9	IEEE Interface Cable	3 meters

Model 1585, RF Cables

MODEL #	CONNECTOR TYPE	SWR (MAX)	INSERTION LOSS (MAX)	FREQUENCY RANGE	LENGTH
1585-1000	SMA Male/SMA Male	1.4	1.9 dB	dc -18 GHz	914 mm (36 in)
1585-1001	SMA Male/SMA Male	1.4	0.7 dB	dc -18 GHz	203 mm (8 in)
1585-1002	SMA Male/SMA Male & BNC Male/BNC Male	1.4 - - -	1.9 dB - - -	dc -18 GHz - - -	914 mm (36 in) 914 mm (36 in)
1585-1003	SMA Male/SMA Male	1.4	1.0 dB	dc - 18 GHz	305 mm (12 in)
1585-1004	SMA Male/BNC Male	1.4	1.0 dB	dc - 18 GHz	305 mm (12 in)
1585-1005	SMA Male/SMA Right Angle Male	1.4	1.9 dB	dc - 18 GHz	914 mm (36 in)
1585-1006	N Male/N Male	1.5	2.65	RF	914 mm (36 in

HIGH POWER SIGNAL SOURCES
CW and Pulse



By Lucas Epsco

HIGH POWER SIGNAL SOURCES

Lucas Epsco has been long established as the leading industry supplier of high power CW and Pulsed Signal Sources. These instruments employ unique technologies and rare manufacturing skills which Lucas Epsco has maintained and refined over the years. The heart of these instruments, the cavity oscillator, is produced in a number of models covering different frequency bands for the standard instruments. The CW instrument, producing up to 250 watts of power, covers the range from 50 to 1900 MHz. Two standard Pulsed sources are included in the instrument line, one capable of 5 KW and the other 40 KW of output power. The instruments are applied to a wide range of applications among them, medical research, calibration, test, simulation and metrology. One of the common applications of the CW instrument is in radiotherapy and hyperthermia treatment of cancer.

Years of experience and a solid reputation for performance and reliability have maintained Lucas Epsco's position of leadership in the high power instrument field. This reputation and experience along with the ability to integrate new and mature technologies has resulted in the design of many special high power test systems. An example of this is the dual-programmable pulse source designed and produced for a major defense contractor as part of the support system of the U.S. Navy's A-6E program. This instrument produces 10 KW at X-Band and 65 KW at Ku-Band and the unit incorporates full IEEE-488 compatibility. A similar pulse source operating at Ku-Band with 60 KW output power is being produced for integration in the test system for the U.S.N. A-7 program. Lucas Epsco will continue to entertain special high power test requirements to which the combined technologies and experience available in its engineering groups can be applied.

CAVITY OSCILLATORS

The heart of the instruments described in this section is the cavity oscillator employed in the various RF Oscillator plug-in units. The Lucas Epsco Cavity Oscillators consist of a triode tube mounted in a precision machined triaxial cavity. Each cavity is silver plated, then rhodium finished to prevent corrosion. The drive mechanism and precision lead-screw provide accurate, trouble free tuning. Beryllium copper contacts ensure long life and reliability. Lucas Epsco has been an established leader in this mature technology for many years.

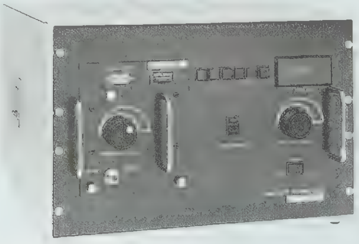
MAGNETRON PLUG-IN UNITS

Lucas Epsco magnetron plug-in units are designed to extend the upper frequency limit of the PG5KB, PH40KB and MH300 beyond that which can be achieved by the cavity oscillator plug-in units. Frequency limits of the magnetron plug-in units are based on the availability of magnetrons which will operate within the power capabilities of the pulse source involved.

The magnetron heads are designed for direct plug-in to the PG5KB and PH40KB instruments. The MH300 peak power modulator is not designed to accommodate plug-in heads, however, the PH40KB magnetron plug-ins may be used externally of the MH300.

If you would like more information, or a demo of these HIGH POWER SIGNAL SOURCES (pages 186 through 191), contact Lucas Epsco by calling (508) 435-2400 or by FAX (508)435-2022.

EP250C
HIGH POWER CW SIGNAL SOURCE



FEATURES

- Frequency range 50-1900 MHz
- Output in excess of 250W over most of frequency range
- Plug-in RF Oscillators
- Direct reading frequency dial
- Digital readout of forward and reflected power

APPLICATIONS

- EMC
- Metrology
- Medical Research
- Meter Calibration
- Component Testing
- Simulation

A versatile self-contained generator of CW power, the Model EP250C is a solid state instrument which accepts RF oscillator plug-ins. Internal protective circuits guard against operation that could reduce component life, thereby greatly increasing the overall reliability of the RF generator.

The RF oscillator plug-ins are easily interchanged and each unit is individually calibrated for RF power meter accuracy. Frequency is read on a direct reading dial on the front panel of each plug-in. An RF coupling adjustment optimizes the oscillator/load impedance match to provide the best power output and frequency stability conditions. Designed to be mechanically and electrically stable, each cavity oscillator is silver-plated and rhodium flashed to prevent corrosion. Over the range of 50-1900 MHz, the output power is typically in excess of 250 Watts.

SPECIFICATIONS

FREQUENCY:

Range: 50-1900 MHz (varies with Plug-ins)
Stability: 0.05 %/hr. @ constant conditions (typical)
Reset accuracy: < 0.5 %

LOAD IMPEDANCE: 50 Ω

SWR: 2:1 maximum @ full power

POWER:

Output: > 225 W from 50-1100 MHz (Figure 1)
Stability: ± 0.5 dB/hr. @ constant conditions
Range: 10 dB (typ.) most plug-ins have dynamic range of > 30 dB
Resolution: 1 watt
Input 50/60 Hz: 115 ± 10 Vac @ 15 A maximum
or 230 ± 10 Vac @ 5A maximum

TEMPERATURE: -5 to +50 °C operating
-40 to +70 °C non-operating

PHYSICAL DIMENSIONS:

Main Frame - Rack 12-1/4"H x 19"W x 25"D
Main Frame - Bench Top 13"H x 20"W x 26"D

WEIGHT: Main Frame - Rack 95 lbs
Main Frame - Bench Top 136 lbs.
Plug-ins - 20 lbs

SAFETY FEATURES:

Interlocks: Main Frame, plug-ins
Circuit protection with indicators: Temperature
Anode Current
VSWR

Fuses: Line voltage (dual)
Low & High Voltage

ORDERING INFORMATION:

Add to model number the digit for line voltage desired and the letter indicating package style.

Example

EP250C 1 R

Model

1 = 115V
2 = 230V

R = Rack
B = Benchtop

Order Plug-in units separately by model number. Refer to Standard RF Oscillator Plug-in Units, page 191.

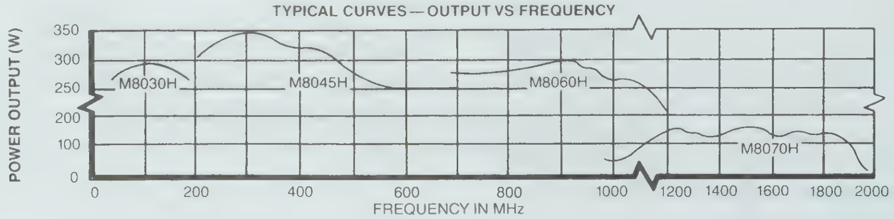


Figure 1. Typical Curves - Output vs Frequency

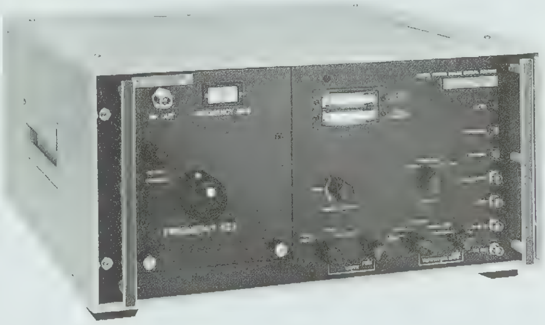
PG5KB
HIGH POWER PULSED SIGNAL SOURCE

FEATURES

- Frequency range 150-4000 MHz
- Upper frequency limited only by available magnetrons
- Plug-in RF Oscillators (cavity or magnetron)
- Continuously variable output power, PW and PRF

APPLICATIONS

- EMC
- Medical Research
- Metrology
- Simulation
- Component Testing
- Behavioral Research



A versatile self-contained generator of RF pulsed power, this instrument covers the frequency range of 150 to 4000 MHz by means of tunable, plug-in cavity oscillator heads. The highest frequency is limited only by available magnetrons. Controls are provided for continuous adjustment of peak output power, pulse width, and repetition rate.

Front panel connectors permit synchronizing from an external trigger source as well as synchronizing external equipment with the internally generated trigger pulse. Alternatively, a pulse from an external generator may be used, in which case, the pulse forming circuit is disabled.

All important voltages and currents are monitored on front panel meters. An external viewing jack, automatic overload protection, and time delay and sequencing circuits are provided. Special options are available.

SPECIFICATIONS

FREQUENCY:

Range: 150-4000 MHz (varies with Plug-ins)
Stability: 0.05 %/hr. @ constant conditions (typical)
Calibration Accuracy: ±0.2%

LOAD IMPEDANCE: 50 Ω

SWR: 1.5:1 maximum

PULSE CHARACTERISTICS:

PRF: 20-25,000 PPS
Pulse Width: 0.3-50 microsec (varies with Plug-ins)
Duty Cycle: 0.005 maximum
Type: Grid pulsed
Rise Time: < 50 nsec (typical)
Fall Time: < 150 nsec (typical)
Jitter: < 100 nsec
Power Between: < 50 dB

POWER:

Output: to 5000 watts peak (varies with Plug-ins)
Stability: ±0.5 dB @ constant conditions for 1 hr (typical)
Range: 10 dB (typical)
Resolution: 0.01%
Input 50/60 Hz: 115 ± 10 Vac @ 4 A (230 V optional)

INTERFACE VOLTAGES:

Sync output: + 10V
Sync input: + 10V
Pulse input: + 5V

TEMPERATURE: 15 to 45 °C operating
-20 to 70 °C non-operating

PHYSICAL DIMENSIONS: 10 "H x 19.63 "W x 21.75 "D (Rack or Bench top)

WEIGHT:

Main Frame - Rack	33 lbs
Main Frame - Bench Top	55 lbs
Plug-ins -	10 lbs

ORDERING INFORMATION:

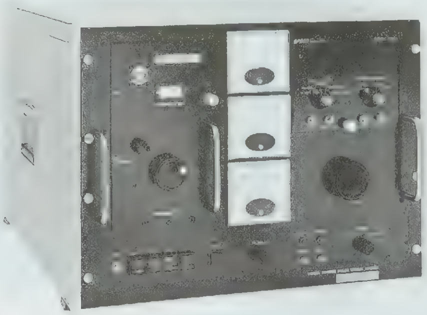
Add to model number the digit for line voltage desired and the letter indicating package style.

Example

PG5KB 1 R
Model
1 = 115V
2 = 230V
R = Rack
B = Benchtop

Order Plug-in units separately by model number. Refer to Standard RF Oscillator Plug-in Units, page 191.

PH40KB
HIGH POWER PULSED SIGNAL SOURCE



FEATURES

- Frequency range 150-4000 MHz
- Upper frequency limited only by available magnetrons
- Plug-in RF Oscillators (cavity or magnetron)
- Continuously variable output power, Pulse Width and PRF

APPLICATIONS

- EMC
- Plasma Research
- Behavioral Research
- Component Testing
- Simulation - IFF, Radar, DME, Tacan, Transmitter

An internal solid state pulse generator provides pulses continuously variable in repetition rate from 10 to 10,000 pps and in width from 0.4 to 25 µsec.

Front panel connectors permit synchronizing from an external trigger generator or bypassing the internal pulse generator for special applications.

All important voltages and currents can be continuously monitored on front panel meters. Video and current viewing jacks, automatic overload protection, safety interlocks, time delay and sequencing circuits are provided.

A regulated high voltage supply is used to simplify external pulsing.

The PH40KB can be externally pulsed or triggered.

SPECIFICATIONS

FREQUENCY:

Range: 150-4000 MHz (varies with Plug-ins)
Stability: 0.5%/hr. @ constant conditions (typical)
Reset Accuracy: 0.1%
Overall accuracy: 0.5% @ maximum rated power and optimum coupling

LOAD IMPEDANCE: 50 Ω

SWR: 1.5 maximum

PULSE CHARACTERISTICS:

PRF: 10-10,000 pps
Pulse Width: 0.4-25 µsec*
Duty Cycle: (varies with Plug-ins)
Type: cathode pulse
Rise Time: < 100 nsec (typical)
Fall Time: < 200 nsec (typical)
Droop: < 0.5 %/µsec

POWER:

Output: to 40 KW (varies with Plug-ins)
Stability: ± 0.5 dB @ constant conditions for 1 hr
Range: 10 dB (typical)
Resolution: 0.01%
Input 115 ± 10 Vac @ 15 A (230V optional)
Interface voltage: +5V

*Limited by magnetron specs when magnetron plug-ins used.

TEMPERATURE: 15 to 45 °C operating
-20 to 70 °C non-operating

DIMENSIONS:

Main Frame - Rack 14 "H x 19 "W x 22.25 "D
- Bench Top 15 "H x 20 "W x 26 "D

WEIGHT: Main Frame - Rack 105 lbs
Main Frame - Bench Top 137 lbs

PULSE MODULATOR: The Model PH40KB may be used as a hard-tube pulse driver for magnetrons and other microwave devices requiring high power pulses. The instrument contains all necessary power supplies including an isolated low-capacitance, variable filament supply to ensure proper magnetron operation. Specifications for PH40KB as a modulator:

Pulse Voltage: -2 to -8 KV @ 0.003 duty cycle
Max Pulse Voltage: -9 KV @ 0.001 duty cycle

Max Pulse Current: 12 A @ -8 KV (Figure 1, page 191)
Maximum Effective Duty Cycle: 0.003 **
Maximum Load Impedance: 800 Ω, 50pF
Filament Supply: 0-7 V @ 5.5 A
Metering: Pulse Voltage Average current
Filament Voltage

** Higher duty cycle permitted at reduced power.

PULSE CHARACTERISTICS:

Width: 0.4-25 µseconds
PRF: 10-10,000 pps
Rise Time: 100 nsec maximum
Fall Time: 400 nsec maximum
Droop: 0.5%/µsec maximum

Order Plug-in units separately by model number. Refer to Standard RF Oscillator Plug-in Units, page 191.

MH300
PEAK POWER PULSE MODULATOR

FEATURES

- 100 KW capability
- Continuously variable power output
- PRF variable from 10-10,000 pps
- Pulse Width variable from 0.4-25 μsec
- Internal/External Sync.

APPLICATIONS:

- ECM
- Behavioral Research
- Component Testing
- Plasma Research
- Simulation - IFF, Radar, DME, Tacan, Transmitter

Model MH300 is a hard-tube pulse driver for magnetrons and other microwave devices requiring high power pulses. Contains all necessary power supplies including an isolated low-capacitance, variable filament supply to ensure proper magnetron operation. For lower power pulse modulator applications, the Model PH40KB may be used.

An internal solid state pulse generator provides pulses continuously variable in repetition rate from 10 to 10,000 pps and in width from 0.4 to 25 microsec.

Front panel connectors permit synchronizing from an external trigger generator or bypassing the internal pulse generator for special applications.

All important voltages and currents can be continuously monitored on front panel meters. Video and current viewing jacks, automatic overload protection, safety interlocks, and time delay and sequencing circuits are provided.

The MH300 can be externally pulsed and triggered.

SPECIFICATIONS

PULSE VOLTAGE: -2 to -18 kV @ 0.001 duty cycle
MAXIMUM PULSE: -18 kV
VOLTAGE: @ 0.001 duty cycle
MAXIMUM PULSE: 16A @ -18 kV
CURRENT (refer to derating curve, Figure 1)
MAXIMUM EFFECT: 0.001
DUTY CYCLE (Maximum Load Impedance):
800 Ω, 50 pF
FILAMENT SUPPLY: 0 to 15 V @ 3A
METERING: High Voltage
Average Current
Filament Voltage

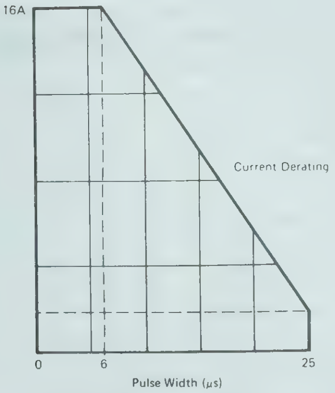


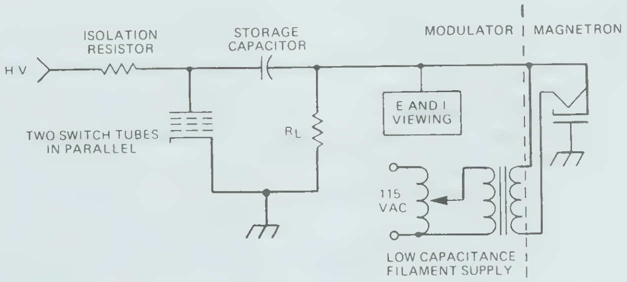
Figure 1. Derating Curve

PULSE CHARACTERISTICS:

Width:	0.4 to 25 μsec
Repetition Rate:	10 to 10,000 pps
Rise Time:	100 nsec maximum
Fall Time:	400 ns maximum
Droop:	0.5%/μsec maximum
Interface Voltages:	+5 V

INPUT POWER: 115 V, 15 A, 50/60 Hz (230 V optional)

PHYSICAL DIMENSIONS: 19" x 27" x 23"
WEIGHT: 150 pounds



All input and output signals to the pulse generator are +5.0 V nominal.

NOTE: The MH300 Is capable of driving any of the RF plug-ins used with the PH40KB High Power Pulsed Signal Source. Plug-in should be ordered separately by model number. Refer to Standard RF Oscillator Plug-in Units, page 191.

Lucas Aerospace
Communications & Electronics

EP100K
DUAL PROGRAMMABLE PULSED SIGNAL SOURCE

FEATURES

* IEEE-488 Bus compatible
* Completely programmable PRF, PW and frequency
* Programmed from either front panel or over Bus
* Accepts two plug-in modulators
* Capable of up to 100 KW output at 0.001 duty cycle
* Built-in "self-test" feature

The Epsco EP100K is a dual programmable High Power Pulsed Signal Source capable of up to 100 KW output power at a 0.001 duty cycle. The unit is ideally suited for automatic test equipment applications requiring this level of power and being IEEE-488 Bus compatible. The outputs are completely programmable from either the front panel or over the Bus for PRF, pulse width and frequency. The EP100K is designed to accept two plug-in modulators allowing for flexibility and maintainability. Each plug-in modulator provides for a "sample" output as well as the "main" output and has its own elapsed time meter. Rear panel outputs include frequency agility signal and pre-trigger. Front panel LED displays show frequency, PRF and Pulse Width. The unit design includes a built-in self test which determines that functional operation and major components have not malfunctioned. The results of self tests are displayed on the front panel and available to a controller via the IEEE-488 Bus interface.

SPECIFICATIONS

FREQUENCY: Dependent on choice of plug-in modulator (Refer to Standard RF Oscillator Plug-in Units, page 191)

OUTPUT POWER: Up to 100 KW (dependent on magnetron in chosen plug-in, page 191).

DUTY CYCLE: 0.001 maximum
PHYSICAL DIMENSIONS: 19 "W x 19.22 "H x 24 "D
WEIGHT: 170 lbs (approximately) with 2 plug-ins
INPUT POWER: 115V ± 10%, 47-63 Hz @ 10 A
TEMPERATURE: 20 ˚C ± 5 ˚C

FUNCTION PROGRAMMING: Remote Control via IEEE-488 Bus of following functions:

a. Plug-in source A
b. Plug-in source B
c. Specific frequency
d. PRF
e. Pulse width
f. Frequency agility mode
g. Self-test
h. Front panel blanking

RESPONSES: The following conditions are indicated via the IEEE-488 Bus:

a. Plug-in source A ready
b. Plug-in source B ready
c. Self tests passed
d. Self test/malfunction diagnostic code
e. Interlock open

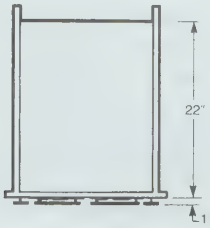
FREQUENCY AGILITY SIGNAL:

Amplitude:	± 1.0V to ± 2.5V (5 V P/P maximum)
Frequency:	200 ± 40 Hz (sinusoidal)
Scale factor:	0.1V/MHz
Output Impedance:	50 Ω
Connector:	BNC

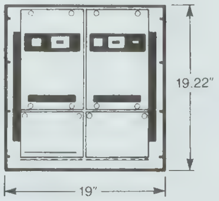
PRE-TRIGGER OUTPUT:

Amplitude:	T^2L level pos. pulse
Frequency:	As PRF selected
Xmtr delay:	300 ± 50 nsec re leading edge
Pulse Width:	500 nsec (nominal)
Connector:	BNC

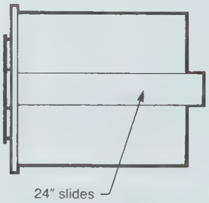
External Drive Capability: 50 Ω



TOP



FRONT



SIDE

STANDARD RF OSCILLATOR PLUG-IN UNITS

EP250C Standard RF Oscillator Plug-in Units:

Frequency (MHz)	Model	Output Power* (Watts)
50-200	M8030H	250
200-700	M8045H	250
700-100	M8060H	225
1100-1900	M8070H	75

* Power listed is guaranteed minimum throughout frequency band covered.

PH40KB Standard RF Oscillator Plug-in Units:

Frequency (MHz)	Model	Duty Cycle* (Max)	Output Conn	Power Out** (kW)	Max Pulse Width* (µsec)
150-300	1701HB	0.001 @ -6.0 kV	HN	10	12
225-450	1702HB			15	12
450-700	1703AHB			15	12
700-950	1703BHB			15	12
950-1220	1704HB			15	12
1220-1535	1705HB			15	12
1535-1900	1706HB			15	12
1900-2350	1707HB			10	12
2350-2700	1708HB			10	12
2700-3100	1709HB			10	12
3100-3400	1710HB			5	12
3300-3700	6302HB	0.0033 @ -3.5 kV	TNC	1.8	6
3700-4000	6303HB			1.2	6
700-850	519HB	0.003 @ -7 kV	HN	40	10
800-1000	526HB			40	10
1000-1200	520HB			40	10
1140-1290	528HB			40	10

* Higher duty cycle and wider pulses permitted at reduced power. Cavities can be optimized for higher power over a narrower frequency range.

** Power listed is guaranteed minimum throughout frequency band covered. Magnetron plug-ins to extend frequency range are available.

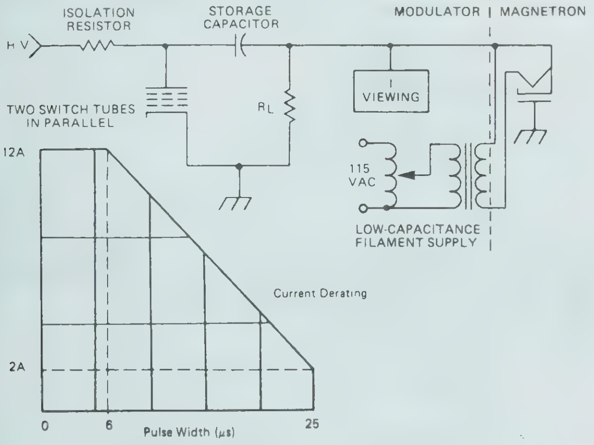


Figure 1. PH40B used as Modulator

PG5KB Standard RF Oscillator Plug-in Units:

Frequency (MHz)	Model	Duty Cycle* (Max)	Power Out** (W)	Max Pulse Width*
150-250	5231H	.005	4000	10
250-450	5232H	.005	5000	10
450-950	5233H	.005	5000	10
950-1220	5234H	.005	5000	10
1220-1535	5235H	.005	5000	10
1535-1900	5236H	.005	5000	10
1900-2350	5237H	.005	5000	10
2350-2700	5238H	.005	4500	10
2700-3100	5239H	.005	4000	10
3100-3400	6341H	.005	3000	20
3300-3700	6342H	.005	2000	10

* Higher duty cycle and wider pulses permitted at reduced power. Cavities can be optimized for higher power over a narrower frequency range.

** Power listed is guaranteed minimum throughout frequency band covered. Magnetron Plug-ins to extend frequency range are available.

EP100K Standard Plug-in Modulator Units*:

Model 16506-75:

OUTPUTS:	Main	Sample
FREQUENCY:	16.0 to 17.0 GHz	16.0 to 17.0 GHz
PEAK POWER:	65-75 KW	6.5-7.5 mW
PRF:	300,800 or 2400 pps	300,800 or 2400 pps
PULSE WIDTH:	0.2, 0.4, 1.2 or 3.0 µsec	3.0 µsec
CONNECTOR:	Waveguide RG-91U with modified UG-419/U cover flange (quick disconnect)	Type N female, precision stainless
COUPLING:		70 ± 2 dB

Model 9011-10:

OUTPUTS:	Main	Sample
FREQUENCY:	9.5 to 10.5 GHz	9.5 to 10.5 GHz
PEAK POWER:	4.5-10 KW	4.5-10 mW
PRF:	300,800 or 2400 pps	300,800 or 2400 pps
PULSE WIDTH:	0.2, 0.4, 1.2 or 3.0 µsec	3.0 µsec
CONNECTOR:	Waveguide RF-52/U with modified UG-39/U cover flange (quick disconnect)	Type N female, precision stainless
COUPLING:		60 ± 2 dB

MICROWAVE FERRITE DEVICES
Waveguide and Coaxial Circulators and Isolators

By Microwave Technologies

INTRODUCTION

The Microwave Technologies Division is a leading supplier of coaxial, waveguide and mixed media ferrite components up to 30 GHz. Emphasis on telecom and satcom band requirements has resulted in a range of products ideally suited for OEM terrestrial communications and earth terminal applications.

While standard products are listed on the following pages, the Microwave Technologies Division's specialty is the custom design of ferrite components to specific OEM needs.

GENERAL INFORMATION

CONNECTORS: SMA connectors are passivated stainless steel or gold plated; Type N connectors are generally finished in bright nickel. Standard flanges on waveguide units are iridite finished aluminum with tapped or clearance hole as specified by the option ordered. The CMR hole pattern on WR112 products is consistent with a UG138 flange.

POWER: Products are rated at 10 watts forward power unless otherwise specified.

PHYSICAL DIMENSIONS: Tolerance on dimensions is ± 0.51mm (0.02 in) exclusive of coaxial connectors. Tighter tolerances are available upon request.

ENVIRONMENTAL CONDITIONS: Normal operating temperature ranges are indicated for each product. All products are designed to operate in up to 95 % humidity, and to withstand shock and vibration as encountered in normal shipment and commercial use.

FINISHING AND MARKINGS: A light iridite finish on aluminum contact surfaces and Hammertone grey paint is standard on most products. Special finishes are availabe upon request. Each product is marked with date, serial number code and circulation direction.

QUALITY ASSURANCE AND TESTING: All products are measured to the appropriate mechanical specifications and electrically tested. A certification statement is supplied with each shipment. Complete test data is available upon order. MIL Standard program requirements are performed on a custom basis.

SPECIFICATIONS: Specifications are subject to change and products may be discontinued without notice.

WARRANTY: All products are warranted to the purchaser for defect-free materials, workmanship, and performance for a period of 12 months from date of shipment when operated within the specified RF and environmental conditions. Seller liability is limited to repair, replacement or credit as determined by the Microwave Technologies Division.

AVAILABLE PRODUCT OPTIONS:

- RF Shielding to -90 dBc at 4" from Product.
- Broader Temperature Ranges.
- Custom Packaging, Finishes, and Marking.
- Complete Test Data.
- Higher Power Ratings.
- Tighter Dimension Tolerances.
- MIL Standard Quality Programs.

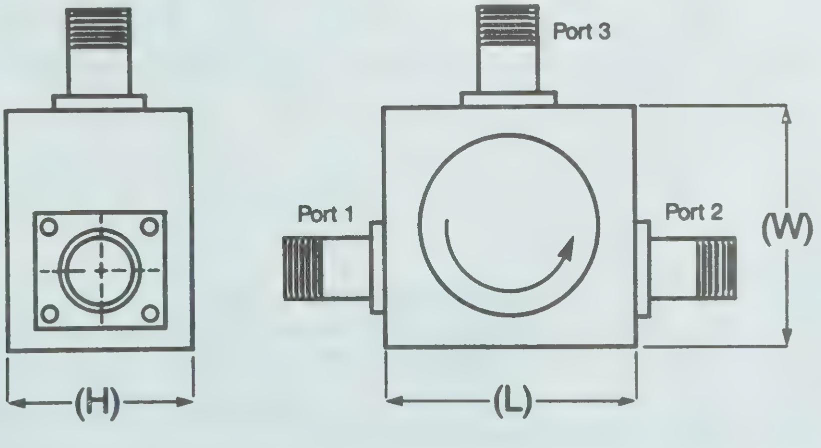
If you would like more information on these MICROWAVE FERRITE DEVICES (pages 193 through 196) or other capabilities, contact Microwave Technologies by calling (416) 625-4605 or by FAX (416) 625-4274.

Coaxial Circulators & Isolators

MODEL #	Frequency (GHz)	Minimum ISOL (dB)	Maximum I.L. (dB)	Minimum R.L. (dB)	Op Temp Range (˚C) Min/Max	Dimensions Inches/**mm**			Available Connectors Load Ratings
						L	W	H	
C154-140-*	1.40-1.54	23	0.40	23	-20/65	1.78 **45.2**	1.98 **50.3**	1.18 **30.0**	SMA(F), SMA(M) 1, 10, 15 W Loads
C204-480-*	1.56-2.04	19	0.50	19	0/65	2.00 **50.8**	2.00 **50.8**	1.00 **25.4**	SMA(F), SMA(M), N(F) 5, 15 W Loads
C210-400-*	1.70-2.10	19	0.40	19	10/65	2.00 **50.8**	2.00 **50.8**	1.00 **25.4**	SMA(F), SMA(M), N(F) 5, 15 W Loads
C230-400-*	1.90-2.30	19	0.40	19	-10/65	2.00 **50.8**	2.00 **50.8**	1.00 **25.4**	SMA(F), SMA(M), N(F) 5, 15 W Loads
C270-220-*	2.48-2.70	23	0.30	23	-20/65	2.00 **50.8**	2.00 **50.8**	1.00 **25.4**	SMA(F), SMA(M), N(F) 5, 15 W Loads
C420-700-*	3.50-4.20	21	0.25	21	-20/65	1.54 **39.1**	1.45 **36.8**	0.74 **18.8**	SMA(F), SMA(M) 1, 10 W Loads
C420-500-*	3.70-4.20	23	0.20	23	-20/65	1.50 **38.1**	1.70 **43.2**	1.00 **25.4**	SMA(F), SMA(M), N(F) 5, 15 W Loads
C440-400-*	4.00-4.40	20	0.50	20	-55/100	1.00 **25.4**	1.00 **25.4**	0.50 **12.7**	SMA(F), SMA(M) 1, 10 W Loads
C650-600-*	5.90-6.50	23	0.25	23	-20/65	1.54 **39.1**	1.45 **36.8**	0.70 **17.8**	SMA(F), SMA(M) 1, 10 W Loads
C720-800-*	6.40-7.20	23	0.25	23	-20/65	1.54 **39.1**	1.45 **36.8**	0.70 **17.8**	SMA(F), SMA(M) 1, 10 W Loads
C850-1400-*	7.10-8.50	23	0.30	23	-20/65	0.94 **23.9**	1.08 **27.4**	0.57 **14.5**	SMA(F), SMA(M) 1, 10 W Loads
C160-8000-*	8.00-16.00	16	0.80	15	-45/85	0.63 **16.0**	0.81 **20.6**	0.62 **15.7**	SMA(F), SMA(M) 1, 10 W Loads
C122-1500-*	10.70-12.20	23	0.30	23	-20/65	0.51 **13.0**	0.70 **17.8**	0.50 **12.7**	SMA(F), SMA(M) 1, 10 W Loads

*This model dash number is defined by connector and load choice for each port.
The dash number will be factory designated with quotation.

Note: Type N(M) Connectors and other load ratings are available on special order.



Waveguide Circulators & Isolators

MODEL #	Freq (GHz)	W/G Size	Min ISOL (dB)	Max I.L. (dB)	Min R.L. (dB)	Op Temp Range (˚C) Min/Max	Dimensions Inches/**mm**				Waveguide Flange Type	Load Rating	Outline Type
							L	W	H	X			
WJ500-600	4.40-5.00	WR229	28 26	0.15 0.15	28 26	0/50 -30/0, 50/60	4.90 **124.5**	4.29 **109.0**	2.00 **50.8**	2.70 **68.6**	CMR229(all tapped)	--	1
WJ650-600-*	5.90-6.50	WR137	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	3.25 **82.6**	2.76 **70.1**	1.53 **38.9**	1.62 **41.1**	CMR137 (Standard or all clear or tapped)	--	2
WI650-600-*	5.90-6.50	WR137	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	3.25 **82.6**	3.40 **86.4**	1.54 **39.1**	2.25 **57.2**	CMR137 (Standard or all clear or tapped)	5W	3
WJ715-750-*	6.40-7.15	WR137	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	3.25 **82.6**	2.76 **70.1**	1.53 **38.9**	1.62 **41.1**	CMR137 (Standard or all clear or tapped)	--	2
WJ780-700-*-**	7.10-7.80	WR112	28	0.15	28	-20/65	see footnote**				UG138 (clear or tapped) or CMR	--	4
WJ828-550-*-**	7.725 - 8.275	WR112	30	0.15	30	-20/65	see footnote**				UG138 (clear or tapped) or CMR	--	4
WJ850-800-*-**	7.70-8.50	WR112	28	0.15	28	-20/65	see footnote**				UG138 (clear or tapped) or CMR	--	4
WJ850-1380-*-**	7.12-8.50	WR112	26	0.15	26	-20/65	see footnote**				UG138 (clear or tapped) or CMR	--	4
WJ117-1000	10.70 - 11.70	WR90	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	2.40 **61.0**	2.40 **61.0**	1.61 **40.9**	1.57 **39.9**	UG135 (all tapped)	--	1
WJ122-500	11.70 - 12.20	WR75	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	1.75 **44.5**	1.75 **44.5**	1.50 **38.1**	0.97 **24.6**	WR75 (all tapped)	--	1
WI134-150-*	13.25 - 13.40	WR62	23	0.40	23	-55/125	.500 **12.7**	1.31 **33.3**	1.31 **33.3**	-- **--**	UG419 (all clear or all tapped)	5W	5
WJ145-500-75	14.00 - 14.50	WR75	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	1.75 **44.5**	1.75 **44.5**	1.50 **38.1**	0.97 **24.6**	WR75 (all tapped)	--	1
WJ145-500-62	14.00 - 14.50	WR62	30 28	0.10 0.10	30 28	0/50 -30/0, 50/60	1.50 **38.1**	1.50 **38.1**	1.31 **33.3**	0.84 **21.3**	UG419 (all tapped)	--	1
WJ197-900	18.80 - 19.70	WR42	25	0.20	25	0/50	1.67 **42.4**	1.57 **39.9**	1.10 **27.9**	1.09 **27.7**	UG595 (all tapped)	--	1
WJ285-700	27.80 - 28.50	WR28	22	0.30	22	0/50	1.17 **29.7**	1.30 **33.0**	1.00 **25.4**	0.83 **21.1**	UG599 (all tapped)	--	1

THE MODEL DASH NUMBER IS DEFINED AS SHOWN BELOW (e.g. WJ-850-1380-CL-3)

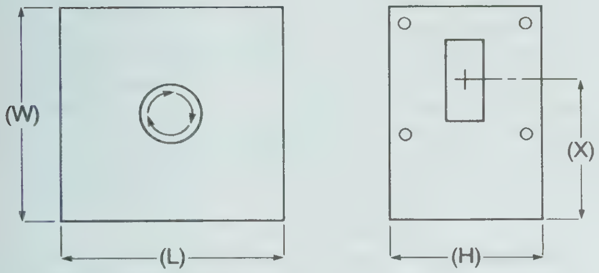
* Flange hole choice where choice exists:
- -ST = Standard Alternate Clear, Tapped Holes
- -CL = All Clear Holes
- -TP = All Tapped Holes
- -CMR = CMR Standard (alternate clear, tapped hole)

** Physical dimension options where choice exists:

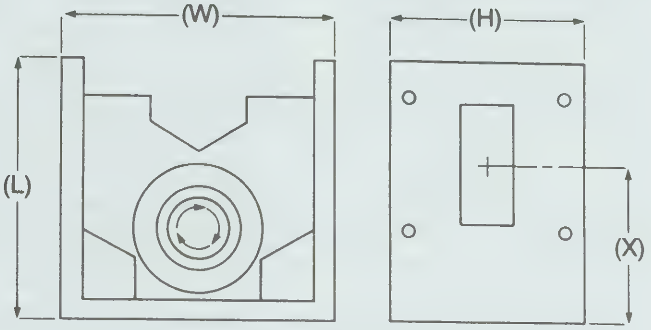
-1 = 2.62/2.47/1.88/1.50 inch for L/W/H/X	**66.5/62.7/47.8/38.1 mm for L/W/H/X**
-2 = 2.62/2.48/1.88/1.51 inch for L/W/H/X	**66.5/63.0/47.8/38.4 mm for L/W/H/X**
-3 = 2.65/2.49/1.88/1.52 inch for L/W/H/X	**67.3/63.2/47.8/38.6 mm for L/W/H/X**

Loads are available at various size, power ratings for the same junction specifications to convert circulator ("WJ") models to isolators. Contact Microwave Technologies for details.

Waveguide Circulators & Isolators Outline Types



Outline
Type 1



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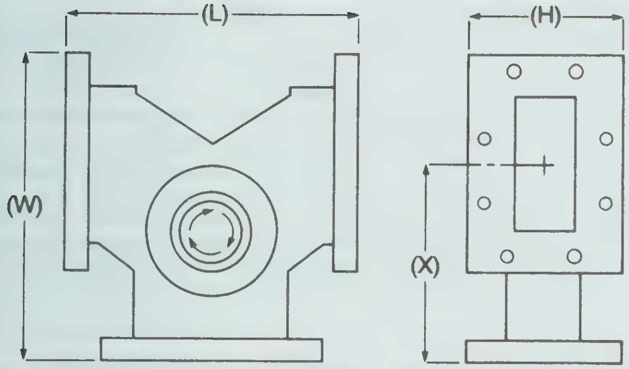

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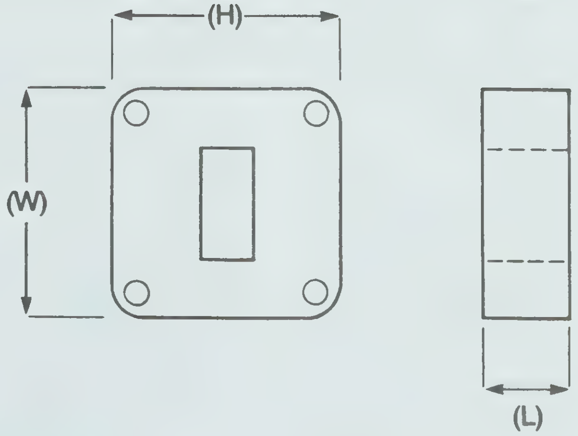
Type 2



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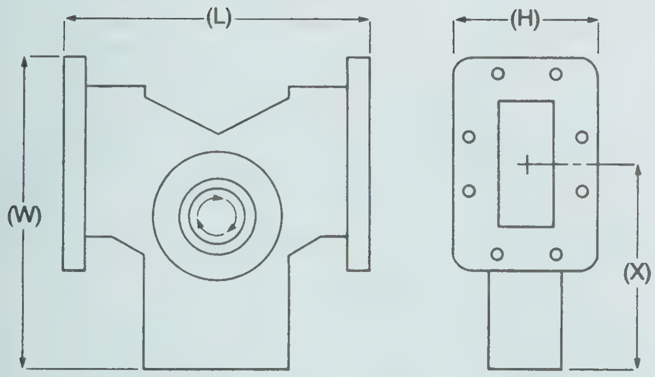


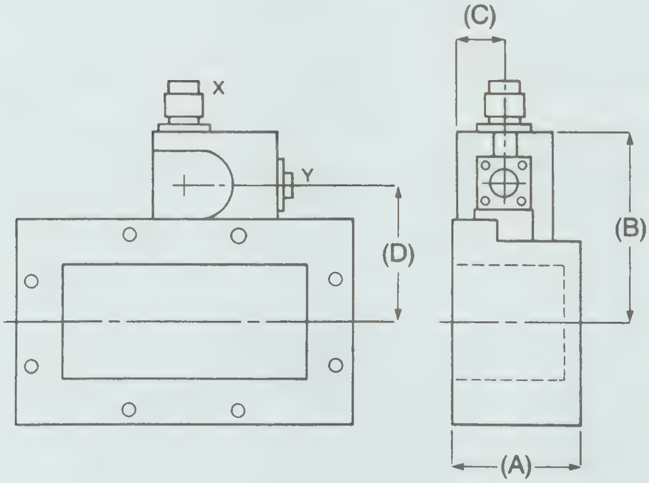
Outline
Type 3

Isodapters

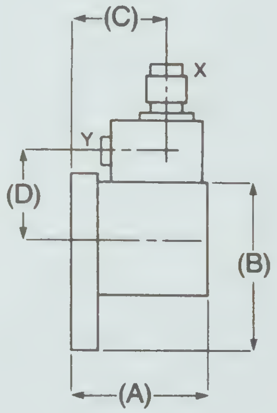
MODEL #	Freq (GHz)	W/G Size	Min ISOL (dB)	Max I.L. (dB)	Min R.L. (dB)	Op Temp Range (˚C) Min/Max	Dimensions Inches/**mm**				W/G Flange Type	Outline Type	Available Connectors Load Rating
							A	B	C	D			
I420-700-*	3.5-4.2	WR229	23 20	.25 .35	23 20	0/60 -30/0	1.20 **30.5**	1.75 **44.5**	0.47 **11.9**	1.28 **32.5**	CMR229 (all tapped)	1	SMA(F), SMA(M) 1, 10 W Loads
I420-500-*	3.7-4.2	WR229	25 22	.25 .35	25 22	0/60 -30/0	1.20 **30.5**	1.75 **44.5**	0.47 **11.9**	1.28 **32.5**	CMR229 (all tapped)	1	SMA(F), SMA(M) 1, 10 W Loads
I650-600-*	5.9-6.5	WR137	25 22	.25 .35	25 22	0/60 -30/0	1.25 **31.8**	1.375 **34.9**	0.87 **22.1**	0.90 **22.9**	CMR137 (all tapped, clear or standard)	1	SMA(F), SMA(M) 1, 10 W Loads
I720-800-*	6.4-7.2	WR137	25 22	.25 .35	25 22	0/60 -30/0	1.25 **31.8**	1.375 **34.9**	0.87 **22.1**	0.90 **22.9**	CMR137 (all tapped, clear or standard)	1	SMA(F), SMA(M) 1, 10 W Loads
I850-1400-*	7.1-8.5	WR112	23	.30	23	-20/65	1.27 **32.3**	1.32 **33.5**	0.87 **22.1**	0.84 **21.3**	UG51 (all clear or tapped)	1	SMA(F), SMA(M) 1, 10 W Loads
I117-1000-*-**	10.7-11.7	WR90	26	.30	26	-20/65	see footnote**				UG39 (all clear or tapped)	2 or 3	SMA(F), SMA(M) 1, 10 W Loads
I122-1500-*-**	10.7-12.2	WR90	23	.35	23	-20/65	see footnote**				UG39 (all clear or tapped)	2 or 3	SMA(F), SMA(M) 1, 10 W Loads
I122-500-*-**	10.7-12.2	WR90	26	.30	26	-20/65	see footnote**				UG39 (all clear or tapped)	2 or 3	SMA(F), SMA(M) 1, 10 W Loads

* This model dash number is defined by choice of input port (waveguide or coaxial), outline type (where choice exists), waveguide flange hole type (where choice exists), load type (1, 10 watt) and load location (X or Y) and connector type [SMA(F), SMA(M)] and connector location (X or Y). The dash number will be factory designated with quotation.

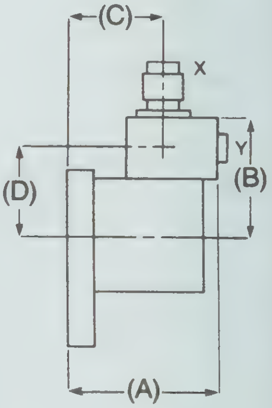
** -2 = 1.21/1.27/0.87/1.03 inch for A/B/C/D **30.7/32.3/22.1/26.2 mm for A/B/C/D**
-3 = 1.35/1.27/0.87/1.03 inch for A/B/C/D **34.3/32.3/22.1/26.2 mm for A/B/C/D**



Outline
Type 1

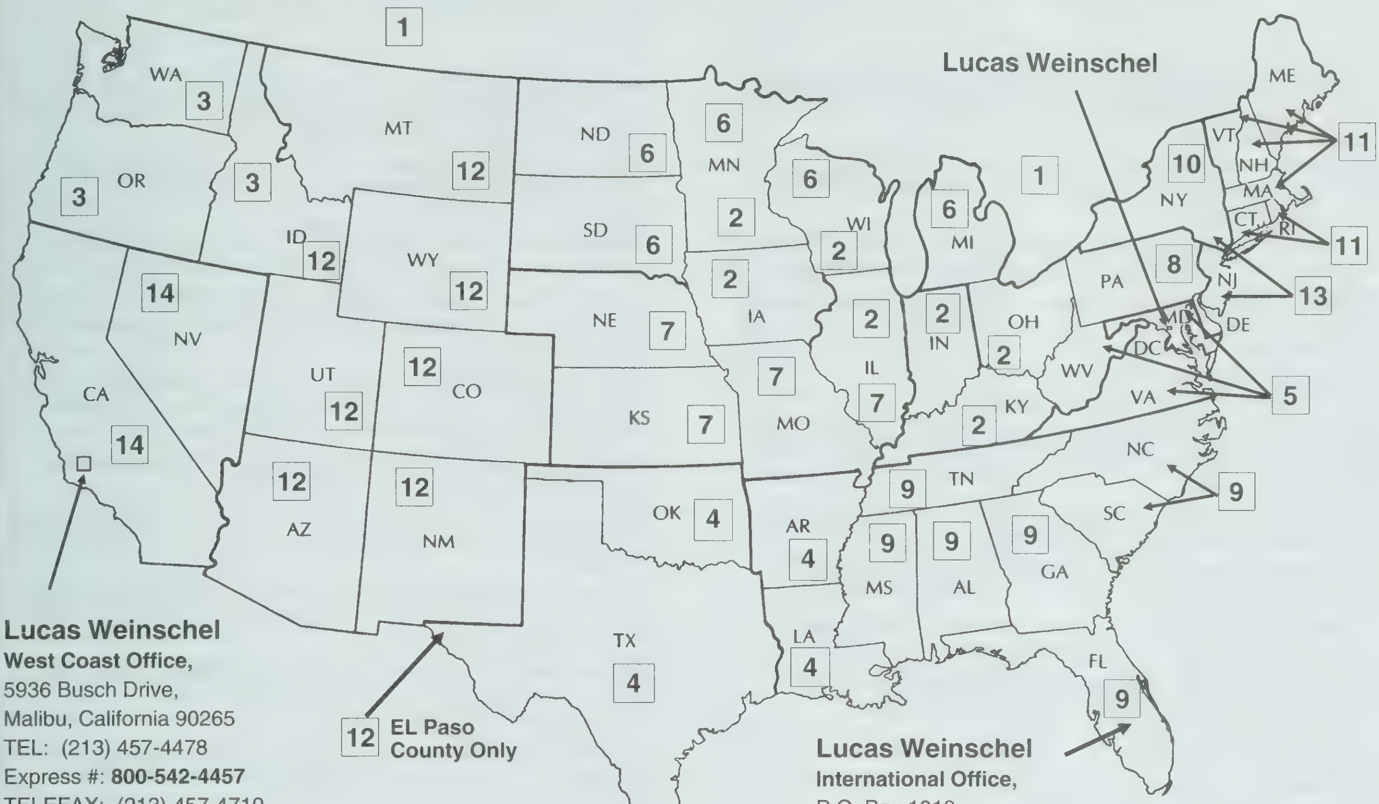


Outline
Type 2



Outline
Type 3

US SALES REPRESENTATIVES



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- ☐ Components & Instruments Cat.
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- ☐ VM-7
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- ☐ Programmable Atten & Controllers
- ☐ Components Express Catalog
- ☐ Instruments Short Form Catalog
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- ☐ Components above 26 GHz
- ☐ Components below 26 GHz
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- ☐ RF and Microwave Parameter Test Instruments
- ☐ Calibration Standards

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- ☐ Production Test
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Applications

- ☐ OEM
- ☐ Production Test
- ☐ Standards and Calibration Facilities
- ☐ R & D, Systems
- ☐ R & D, Components
- ☐ Basic Research, e.g., medical
- ☐ Other ______________________

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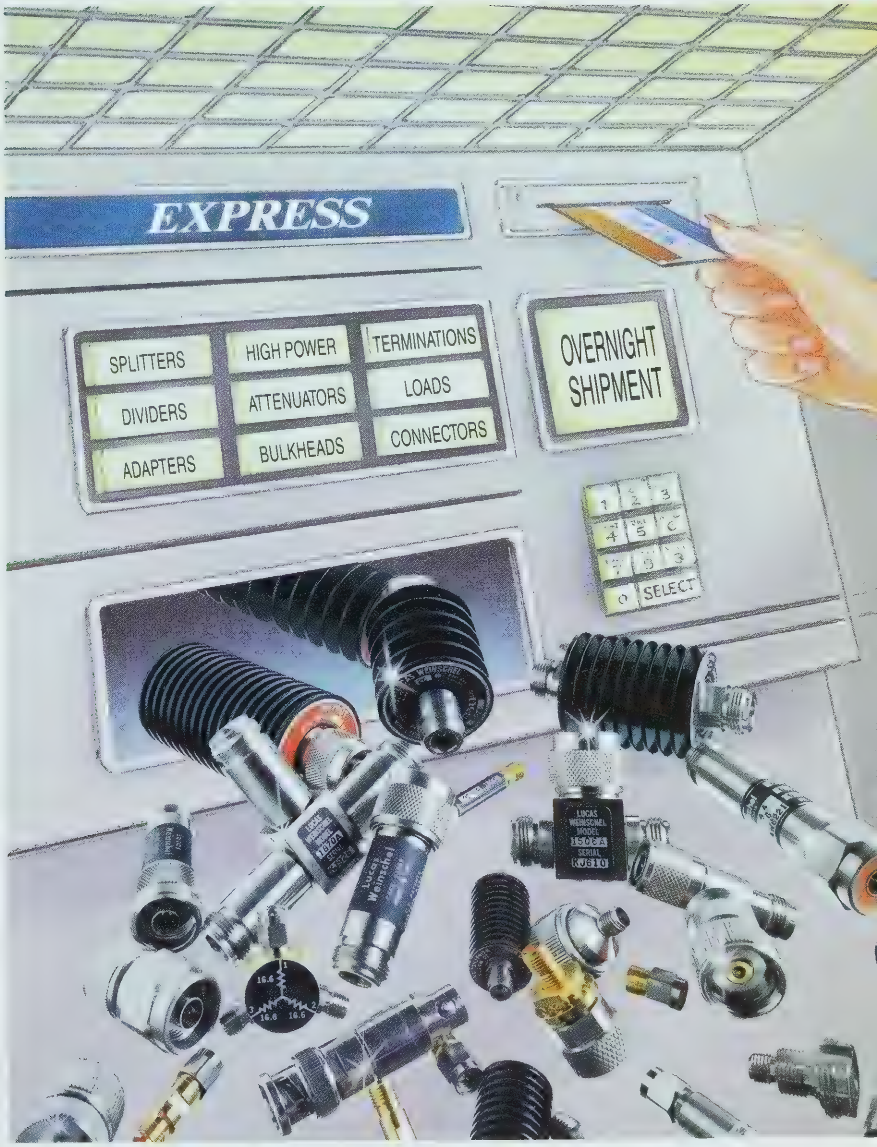
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Devoted to the development and manufacture of the highest quality microwave components and precision microwave measurement and calibration instruments, Lucas Weinschel was established 40 years ago and continues as a leader in the microwave industry.

Weinschel was the first to design and manufacture commercial RF coaxial attenuators in 1948. Today, we offer products that cover the frequency spectrum from dc to 40 GHz. These products are employed in the standards laboratories and quality control departments of most electronic and aerospace companies as well as governmental agencies and private research firms throughout the world. These products are found in numerous applications such as: satellite and surface communication, electronic warfare, electronic countermeasures, navigation, radar, missile guidance, signal analysis, telemetry, air traffic control and precision microwave related instruments and system use. Lucas Weinschel is a name acknowledged to be synonymous with reliability, technical competence, quality, and leadership in state-of-the-art microwave measurements of high accuracy.

Our product line includes:

- Fixed and Variable Attenuators (High Power, Precision and Steps)
- Test Instruments and Calibration Standards (traceable to NIST)
- PLANAR CROWN® and Blind Mate Connector Systems
- Terminations and Adapters
- Programmable Attenuators and Controllers
- Solid State Pin Attenuators, and Switches
- Level Set Attenuators and Phase Shifters
- Custom Products

To help our customers use, calibrate, and maintain our products, we have developed comprehensive training programs available either at our Gaithersburg headquarters or in the field.

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Overnight Shipment

Lucas Weinschel offers the fastest way for you to acquire components for your application or production use. Throughout this Quick-Reference Catalog you will find specific model numbers that are followed by:

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This symbol identifies those products that can be shipped to you from our plant within 24 hours of placing the order. The *Express* also extends its services to other products that may be available in stock at time of order. As with any quick-ship service, some restrictions apply:

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* Including shipping cost.

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NOTE: ***Express*** Delivery services are limited to US & Canadian Customers. International customers please contact your local sales representative or Lucas Weinschel for the quickest available delivery.

Lucas Weinschel hopes that this brochure will provide you with the necessary information and specifications to select the appropriate components from our extensive line of microwave products. When making a selection consider that these components are our standard off-the-shelf products and can be used as starting points or modified as custom products to fit specific applications. Also provided in this brochure are quick reference guides for our attenuator or termination lines to make selecting a component even easier. For more information or any questions about the microwave components or other LW products, contact your local LW Rep or the Sales Department at Lucas Weinschel .

Fixed Attenuator Quick Reference Guide

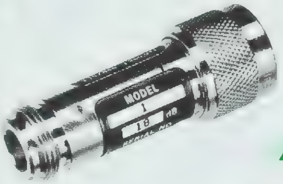
	Model Number	Connector Type	Frequency Range (GHz)	Average Power (Watts)	Peak Power (kW)	Nominal Attenuation Value (dB)	SWR[1]
	3330/3331	SMA	dc-18.0	2	0.25	1 thru 30	1.20-1.50
	4H	SMA	dc-18.6	2	0.25	1 thru 10, 20, 30	1.15-1.35
●	3M/3T	SMA	dc-12.4	2	0.5	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25
●	4M/4T	SMA	dc-18.0	2	0.5	1 thru 10, 20, 30, 40, 50, 60	1.15-1.35
	9	SMA	dc-26.5	2	0.5	3, 6, 10, 20, 30	1.10-1.60
	54	SMA	dc-40.0	2	0.2	3, 6, 10, 20, 30	1.35-1.60
●	56	3.5 mm	dc-26.5	2	0.5	3, 6, 10, 20, 30	1.10-1.25
●	1	N	dc-12.4	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25
●	2	N	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.35
●	44	N	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.15-1.25
●	55	TNC	dc-18.0	5	1	1 thru 10, 20, 30	1.15-1.35
	17	GPC7	dc-18.0	5	1	1 thru 10, 20, 30, 40, 50, 60	1.10-1.20
●	18B	BNC	dc-12.4	5	1	1 thru 10, 20, 30	1.25-1.35
●	41	SMA	dc-18.0	10	1	1, 2, 3, 6, 10, 20, 30	1.20-1.35
●	23	N	dc-18.0	10	1	1 2, 3, 6,10, 20, 30, 40, 50, 60	1.15-1.35
●	33	N	dc-8.0	25	5	3, 6, 10, 20, 30	1.20-1.30
●	24	N/SMA TNC/GPC7	dc-8.0	50	5	3, 6, 10, 20, 30	1.20-1.30
●	46	N	dc-18.0	25	1	3, 6, 10, 20, 30, 40	1.20-1.35
	47	N	dc-18.0	50	1	10, 20, 30, 40	1.20-1.35
●	48	N	dc-18.0	100	1	20, 30, 40	1.25-1.45
	40	N	dc-1.5	150	10	3, 6, 10, 20, 30, 40	1.10
●	45	N	dc-1.5	250	10	3, 6, 10, 20, 30, 40	1.10
	49	N	dc-8.5	150	5	3, 6, 10, 20, 30, 40	1.25-1.35
	53	N	dc-2.5	500	10	10, 20, 30, 40	1.10
	57	N	dc-5.0	150	10	6, 10, 20, 30, 40	1.10
	58	N	dc-5.0	250	10	6, 10, 20, 30, 40	1.10

● *EXPRESS* SHIPMENT AVAILABLE

[1] VARIES WITH FREQUENCY

FIXED ATTENUATORS

Type N Connectors



Models 1& 2

EXPRESS

Model 44

EXPRESS

- * MIL-A-3933 QPL
- * Ruggedized construction
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 1	MODEL 2	MODEL 44
dc - 4	1.15	1.15	1.15
4 - 8	1.20	1.20	1.20
8 - 12.4	1.25	1.25	1.20
12.4 - 18	N/A	1.35	1.25

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 1	MODEL 2	MODEL 44
1 thru 9	±0.3	±0.3	±0.3
10, 20	±0.3	±0.5	±0.5
30, 40	±0.75	±1.0	±1.0
50	±0.75	±1.25	±1.5
60	±1.0	±1.5	±1.5

Power Rating:

5 W average, 1 kW peak

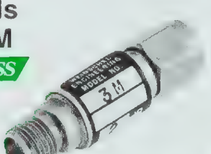
Dimensions:

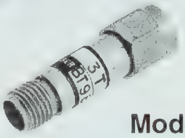
Models 1&2	2.28" long (up to 30 dB) 2.68" long (40 to 60 dB)
Model 44	3" long (up to 30 dB) 3.4" long (40 to 60 dB)

SMA Connectors

Models 3M/4M

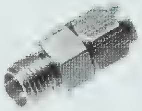
EXPRESS





Models 3T/4T

EXPRESS



Model 4H

- * MIL-A-3933 QPL
- * Ruggedized SMA Connectors (Models 3T, 4T, 3M, & 4M Only)
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 4H	MODEL 3T/3M	MODEL 4T/4M
dc - 4	1.25	1.15	1.15
4 - 8	1.25	1.20	1.20
8 - 12.4	1.25	1.25	1.25
12.4 - 18	1.35	N/A	1.35

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 4H	MODEL 3T/3M	MODEL 4T	MODEL 4M
0	±0.2	N/A	N/A	N/A
1 thru 2	±0.3	±0.3	±0.3	±0.5
3 thru 6	±0.3	±0.3	±0.3	±0.3
7 thru 10	±0.3	±0.3	±0.5	±0.5
20	±0.7	±0.5	±0.7	±0.7
30	±0.7	±0.75	±1.0	±1.0
40	N/A	±0.75	±1.0	±1.0
50, 60	N/A	±1.0	±1.5	±1.5

Power Rating:

2 W average, 500 W peak (250 W peak for 4H only)

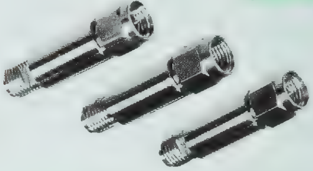
Dimensions:

MODEL	dB VALUE (dim. in inches) 1-10	20	30	40-60
4H	0.75	0.85	0.95	-
3T/4T	0.86	0.94	1.04	1.34
3M/4M	1.2	1.2	1.85	1.85

Ruggedized SMA/ 3.5 mm Connectors

Model 56 (3.5 mm)

EXPRESS



Model 54 (SMA)

EXPRESS

- * Ruggedized construction
- * Low SWR & Flat Response
- * Broadband Frequency Coverage

Model 54	dc-40 GHz
Model 56	dc-26.5 GHz

- * Designed to meet environmental requirements of MIL-A-3933
- * Male/Female Connector options (Model 54 Only)

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 56	MODEL 54
dc - 8	1.10	1.35
8 - 12.4	1.15	1.35
12.4 - 26.5	1.25	1.35
26.5 - 40	N/A	1.60

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 56	MODEL 54
3	±0.5	±0.4-1.1*
6	±0.5	±0.4-1.0*
10	±0.5	±0.4-1.0*
20	±0.5	±0.7-1.0*
30	±0.5	±1.0-1.4*

* Varies with frequency

Power Rating:

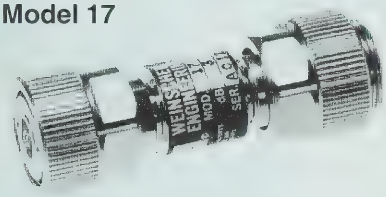
Model 56	2 W average, 500 W peak
Model 54	2 W average, 200 W peak

Dimensions:

Model 56	1.25" long
Model 54	1.75" long

GPC7 Connectors

Model 17



- * Ruggedized construction & High Repeatability connector design
- * Designed to meet environmental requirements of MIL-A-3933

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 17
dc - 4	1.10
4 - 12.4	1.15
12.4 - 18	1.20

MAX Deviation over FREQ

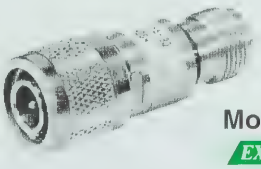
ATTN NOM (dB)	MODEL 17
1 - 9	± 0.3
10, 20	± 0.5
30, 40, 50,	±0.75
60	± 1.0

Power Rating:
5 W average, 1 kW peak

Dimensions:

Model 17	2.28" long (up to 30 dB) 2.68" long (40 to 60 dB)

TNC Connectors



Model 55
EXPRESS

- * MIL-A-3933 QPL
- * New 18 GHz TNC connectors

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 55
dc - 4	1.15
4 - 8	1.20
8 - 12.4	1.25
12.4 - 18	1.35

MAX Deviation over FREQ (dB):

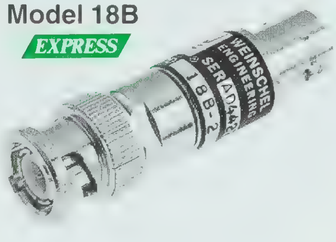
ATTN NOM (dB)	MODEL 55
1 thru 6	±0.4
7 thru 10, 20	±0.5
30	±0.9

Power Rating:
5 W average, 1 kW peak

Dimensions:
Model 55 1.6" long

BNC Connectors

Model 18B
EXPRESS



- * Ruggedized construction
- * Long life connectors
- * Designed to meet environmental requirements of MIL-A-3933

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 18B
dc - 4	1.25
4 - 8	1.30
8 - 12.4	1.35

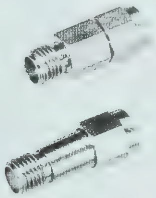
MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 18B
1thru 6	±0.4
7 thru 10, 20, 30	±0.8

Power Rating:
2 W average, 500 W peak

Dimensions:
Model 18B 2" long

SMA Connectors



- * Ruggedized construction
- * Low Cost
- * Two Configurations:

Model 3330	Round Body
Model 3331	Hex Body

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODELS 3330 & 3331
dc - 4	1.20
4 - 12.4	1.40
12.4 - 18	1.50

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	FREQ RANGE (GHz)	
	dc-12.4	12.4-18
1 thru 10	±0.4	±0.6
11 thru 30	±0.5	±0.7

Power Rating:
5 W average, 1 kW peak

Dimensions:
Model 3330 & 3331 0.86" long

HIGH POWER ATTENUATORS

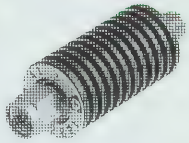
Type N/SMA, 10 Watts

Model 23 (Type N)

EXPRESS

Model 41 (SMA)

EXPRESS



- dc to 18.0 GHz
- Special configurations and male/female connector options
- Designed to meet environmental requirements of MIL-A-3933

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL	
	23	41
dc - 4	1.15	1.20
4 - 8	1.20	1.30
8 - 12.4	1.25	1.30
12.4 - 18	1.40	1.35

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL	
	23	41
1,2	±0.5	±0.5
3, 6	±0.3	±0.3
10	±0.5	±0.5
20	±0.5	±0.7
30	±1.0	±1.0
40	±1.0	N/A
50	±1.25	N/A
60	±1.50	N/A

Power Rating:

10 W average, 1 kW peak

Dimensions:

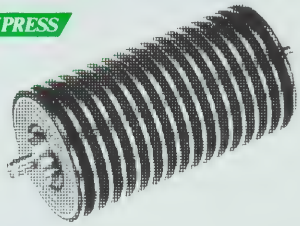
Model	23-XX-YY	2.92" long (MAX)
Model	41-XX-YY	2.03" long (MAX)

XX denotes ATTN value (dB)
YY denotes connector options

Type N/SMA/TNC/GPC7, 25/50 Watts

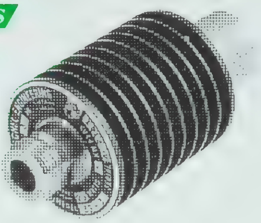
Model 24 (50 W)

EXPRESS



Model 33 (25 W)

EXPRESS



- dc to 8.0 GHz
- Special configurations and male/female connector options (Model 33 Type N Only)
- Designed to meet environmental requirements of MIL-A-3933

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL	
	24	33
dc - 4	1.20	1.20
4 - 8	1.30	1.30

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL	
	24	33
3, 6, 10, 20	±0.4-0.75*	±0.3-0.6*
30	±0.4-0.75*	±0.6-1.0*
40	±0.4-0.75*	N/A

Power Rating:

Model 24	50 W average, 5 kW peak
Model 33	25 W average, 5 kW peak

Dimensions:

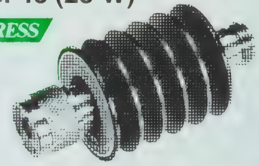
Model	24-XX-YY	4.75" long (MAX)
Model	33-XX-YY	3.55" long (MAX)

XX denotes ATTN value (dB)
YY denotes connector options

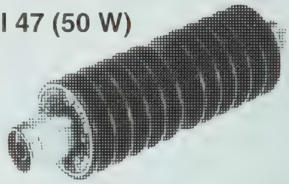
Type N, 25/50/100 Watts

Model 46 (25 W)

EXPRESS



Model 47 (50 W)



Model 48 (100 W)

EXPRESS

- dc to 18.0 GHz
- Special configurations and male/female connector options
- Designed to meet environmental requirements of MIL-A-3933

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL		
	46	47	48
dc -8	1.20	1.20	1.25
8 - 12.4	1.25	1.25	1.35
12.4 - 18	1.35	1.35	1.45

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL		
	46	47	48
3, 6	±0.5	N/A	N/A
10	±0.5	±0.5	N/A
20	±0.75	±0.75	±0.75
30, 40	±1.0	±1.0	±1.0

Power Rating:

Model 46	25 W average, 1 kW peak
Model 47	50 W average, 1 kW peak
Model 48	100 W average, 1 kW peak

Dimensions:

Model	46-XX-YY	4.75" long (MAX)
Model	47-XX-YY	3.55" long (MAX)
Model	48-XX-YY	10.38" long (MAX)

XX denotes ATTN value (dB)
YY denotes connector options

Type N, 150/250 Watts

Model 40 (150 W)

INPUT
150 WATTS

Model 45 (250 W)

Models 57 & 58 not shown.

* Choice of frequency ranges:

Models 40 & 45	dc to 1.5 GHz
Models 57 & 58	dc to 5.0 GHz

* Ruggedized construction

* Special configurations and male/female connector options

SPECIFICATIONS:

MAX SWR:

Models 40 & 45	1.10
Models 57 & 58	1.20

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL		
	40/45	57	58
3, 6, 10, 20	±0.5	±1.25	±1.5
30, 40	±0.5	±1.5	±1.75

Power Rating:

Model 40	150 W average, 10 kW peak
Model 45	250 W average, 10 kW peak
Model 57	150 W average, 10 kW peak
Model 58	250 W average, 10 kW peak

Dimensions:

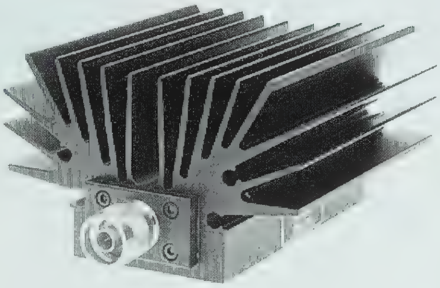
Models	40-XX-YY 57-XX-YY	7.20'" long 3.06" wide (MAX)
Models	45-XX-YY 58-XX-YY	9.60" long 3.06" wide (MAX)

XX denotes ATTN value (dB)
YY denotes connector options

All models contain four 6-32 UNC-2B (thru 1st fin) mounting holes on each end.

Type N, 150 Watts

Model 49



* dc to 8.5 GHz

* Special high temperature support beads

* Special configurations and male/female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 49
dc - 4	1.25
4 - 8.5	1.35

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 49
3, 6, 10, 20, 30	±0.4-0.75*
40	±0.5-1.00*

* Varies with frequency

Power Rating:

150 W average, 10 kW peak

Dimensions:

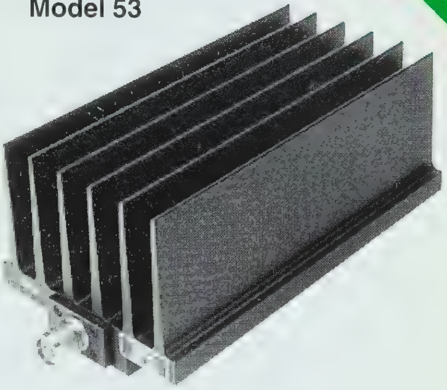
Model	49-XX-YY	7.20'" long 5" wide 3.0" high (MAX)

XX denotes ATTN value (dB)
YY denotes connector options

Contains four 6-32 UNC-2B X 3/8" deep mounting holes located on bottom of unit.

Type N, 500 Watts

Model 53



* dc to 2.5 GHz

* Ruggedized construction

* Special configurations and male/female connector options

SPECIFICATIONS:

MAX SWR: 1.10

MAX Deviation over FREQ (dB):

ATTN NOM (dB)	MODEL 53
20, 30, 40	±0.5

Power Rating:

500 W average, 10 kW peak

Dimensions:

Model	53-XX-YY	12" long 5.5" wide 4.3" high (MAX)

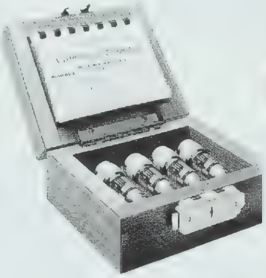
XX denotes ATTN value (dB)
YY denotes connector options

Contains four 6-32 UNC-2B X 3/8" deep mounting holes located on bottom of unit.

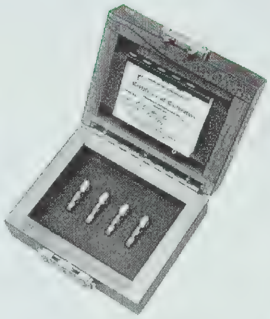
ATTENUATOR SETS & ADAPTERS

Precision Attenuator Sets

Model AS-6

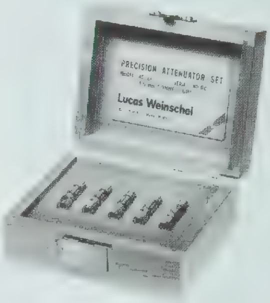


Model AS-16
Model AS-18



Model AS-19

Model AS-20



MODEL	GENERIC MODEL*	NOMINAL VALUES	FREQ RANGE
AS-6	2	3, 6, 10, 20	dc-18 GHz
AS-16	17	1, 3, 6, 10, 20, 30	dc-18 GHz
AS-18	44	1, 3, 6, 10, 20, 30	dc-18 GHz
AS-19	9	3, 6, 10, 20	dc-26.5 GHz
AS-20	56	3, 6,10, 20, 30	dc-26.5 GHz

* Refer to Fixed Attenuator Quick Reference Guide for detailed Attenuator Specifications.

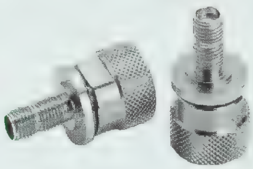
FEATURES:

- Ruggedized construction
- Calibration data supplied with each set
- All attenuators designed to meet environmental requirements of MIL-A-3933 (Some models QPL)
- Durable storage case

Precision SMA Bulkhead

Model 1568
EXPRESS

Model 7001



- dc to 26.5 GHz
- Ruggedized SMA connectors
- Front mounts on any panel
- Stainless steel version (add -1 to model number)

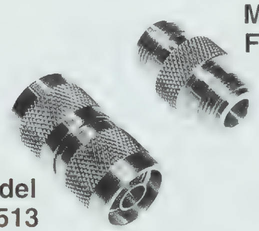
SPECIFICATIONS:

FREQ. (GHz)	SWR	INS LOSS	REPEAT-ABILITY
dc - 12.4	1.15	<0.20 dB	0.01 dB
12.4 - 18	1.15	<0.25dB	0.02 dB
18 - 26.5	1.20	<0.35 dB	0.02 dB

Dimensions:

Model 1568 (F/F)	0.91" long (Mounts into 0.375 "D" hole)
Model 7001 (F/M)	1.14" long (Mounts into 0.375 "D" hole)

Precision Type N



Model F1513

Model M1513

- dc to 18 GHz (usable to 22 GHz)
- Stainless steel construction
- Interface dimensions per Test Port/Lab STD connectors

SPECIFICATIONS:

FREQ (GHz)	SWR	INS LOSS	REPEAT-ABILITY
dc - 10	1.10	<0.25 dB	0.02 dB
10 - 18	1.15	<0.25 dB	0.02 dB

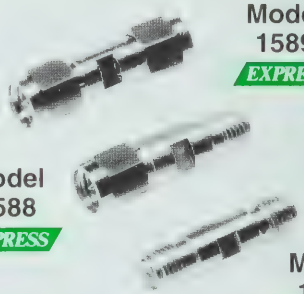
Dimensions:

Model F1513	1.26" long
Model M1513	1.52" long

Connector Type:

Model F1513	female to female
Model M1513	male to male

Precision SMA to SMA



Model 1589
EXPRESS

Model 1588
EXPRESS

Model 1587
EXPRESS

- dc to 26.5 GHz
- Ruggedized SMA connectors

SPECIFICATIONS:

FREQ (GHz)	SWR	INS LOSS	REPEAT-ABILITY
dc - 12.4	1.15	<0.20 dB	0.01 dB
12.4 - 18	1.15	<0.25 dB	0.02 dB
18 - 26.5	1.20	<0.35 dB	0.02 dB

Dimensions:

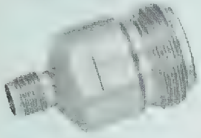
Model 1587	0.92" long
Model 1588	1.03" long
Model 1589	1.07" long

Connector Type:

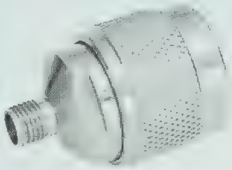
Model 1587	female to female
Model 1588	male to female
Model 1589	male to male

Precision SMA to Type N

Model 7002-13



Model 7002-14



(7002-23, -24 not shown)

- * dc to 18 GHz
- * Ruggedized SMA connectors

SPECIFICATIONS:

FREQ (GHz)	SWR	INS LOSS	REPEAT-ABILITY
dc - 12.4	1.12	<0.4 dB	0.01 dB
12.4 - 18	1.12	<0.5 dB	0.02 dB

Electrical Length:

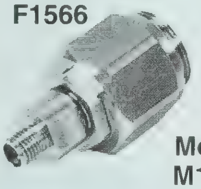
Models	7002-13, -23	33 mm
Models	7002-14, -24	20 mm

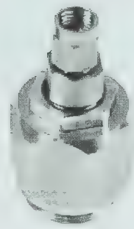
Connector Type:

Model 7002-13	SMA female to N female
Model 7002-14	SMA female to N male
Model 7002-23	SMA male to N female
Model 7002-24	SMA male to N male

Precision SMA to GPC7

Model F1566





Model M1566

- * dc to 18 GHz
- * Phase and attenuation matched

SPECIFICATIONS:

FREQ (GHz)	SWR	REPEATABILITY GPC7	REPEATABILITY SMA
dc - 12.4	1.06	0.005 dB	0.01 dB
12.4 - 18	1.06	0.010 dB	0.02 dB

Insertion Loss:

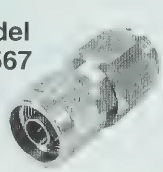
0.43 dB (MAX) per mated pair

Connector Type:

Model F1566	SMA female to GPC7
Model M1566	SMA male to GPC7

Precision Type N to GPC7

Model M1567



Model F1567

- * dc to 18 GHz
- * Ruggedized construction

SPECIFICATIONS:

FREQ (GHz)	SWR	REPEATABILITY GPC7	REPEATABILITY Type N
dc - 4	1.01	0.005 dB	0.01 dB
4 - 8	1.02	0.005 dB	0.01 dB
8 - 12.4	1.03	0.005 dB	0.01 dB
12.4 - 18	1.04	0.010 dB	0.02 dB

Insertion Loss:

0.43 dB (MAX) per mated pair

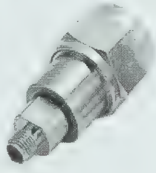
Connector Type:

Model F1567	N female to GPC7
Model M1567	N male to GPC7

LAB STD SMA to Type N Adapters

Model 1548-23

Model 1548-14



(1548-23, -24 not shown)

- * dc to 18 GHz
- * High repeatability

SPECIFICATIONS:

FREQ (GHz)	SWR	REPEATABILITY Type N	REPEATABILITY SMA
dc - 12.4	1.10	0.010 dB	0.01 dB
12.4 - 18	1.10	0.020 dB	0.02 dB

Insertion Loss:

0.43 dB (MAX) per mated pair

Connector Type:

Model 1548-13	SMA female to N female
Model 1548-14	SMA female to N male
Model 1548-23	SMA male to N female
Model 1548-24	SMA male to N male

Blind-Mate Connectors

Model 7009

Model 7008

These connectors can provide the user with threadless connector mating which can be useful when mating an array of connectors on one RF module to another array within seconds. Each connector pair will tolerate a radial and axial offset of 0.02 inch and still meet all of its electrical specifications. These connectors can simplify RF connections in the most inaccessible regions and high package density systems where conventional coupling connector mating is extremely difficult.

Other features include:

- * dc to 40 GHz
- * Custom configurations
- * Pressurized (Model 7008) and Unpressurized (Model 7009) models available

SPECIFICATIONS:*

FREQUENCY RANGE (GHz)	LOSS (MAX dB)	SWR (MAX)
dc - 18	0.3	1.3
18 - 26.5	0.8	1.4
26.5 - 40	1.5	1.65

* Specifications are for mated pair (Mated pair can be any combination of Model 7008 and 7009).

Hydrostatic Pressure:

1000 PSI (Model 7008 only)

Static Pressure:

50 PSI (Model 7008 only)

TERMINATIONS & LOADS

Termination Quick Reference Guide

	Model Number	Connector Type	Frequency Range (GHz)	Average Power (Watts)	Peak Power (kW)	SWR[1]
●	1406A	SMA	dc-18.0	2	0.5	1.05-1.21
●	1408	SMA	dc-18.0	2	0.5	1.04-1.15
	1404	N or GPC-7	dc-18.0	1	1	1.04 (GPC7)/1.06 (N)
	1424	BNC, N, or TNC	dc-12.4	5	5	1.03-1.40
	1425	BNC, N, or TNC	dc-12.4	10	10	1.03-1.40
●	1419	SMA	dc-18.0	10	1	1.20-1.35
	1418	N	dc-18.0	10	1	1.15-1.40
	1427	N	dc-10.0	25	5	1.10-1.15
	1429	N	dc-18.0	25	1	1.20
●	1426	N	dc-8.0	50	5	1.20-1.30
	1430	N	dc-18.0	50	1	1.15-1.30
	1431	N	dc-18.0	100	1	1.15-1.30
	1432	N	dc-8.5	150	5	1.20-1.30
	1433	N	dc-5.0	250	10	1.10
	1435	N	dc-5.0	150	10	1.10
	1434	N	dc-2.5	500	10	1.10

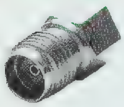
● *EXPRESS* SHIPMENT AVAILABLE

[1] VARIES WITH FREQUENCY

Subminiature SMA

Model F1406A

EXPRESS



Model M1408

EXPRESS

* dc to 18 GHz

* Subminiature size and lightweight

SPECIFICATIONS:

SWR:

Model 1406A	1.05 + 0.009 x f (GHz)
Model 1408	1.04 + 0.006 x f (GHz)

Power Rating:

2 Watts average, 500 W peak

Dimensions:

Models M1406A/M1408	0.56" long (MAX)
Models F1406A/F1408	0.49" long (MAX)

Type N, GPC7

Model 1404N

(1404WPC not shown)

* dc to 18 GHz

* Male/Female connector options

SPECIFICATIONS:

SWR: 1.04 MAX (GPC7)
1.06 MAX (Type N)

Power Rating:

1 Watt Average, 1 kW peak

Dimensions:

Model 1404N	1.59" long (MAX)
Model 1404WPC	1.22" long (MAX)

Connector Type:

Model M1404N	Type N male
Model F1404N	Type N female
Model 1404WPC	GPC7

BNC, Type N, TNC

Model 1424

Model 1425

* dc to 12.4 GHz

* Male/Female connector options

SPECIFICATIONS:

MAX SWR:

1.03 - 1.40 (varies with freq and connector options)

Power Rating:

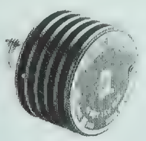
Model 1424	5 W Average, 5 kW peak
Model 1425	10 W Average, 10 kW peak

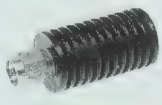
Dimensions:

Model 1424	1.88" long (MAX)
Model 1425	3.40" long (MAX)

EXPRESS 800-542-4457 CALL TOLL FREE TODAY!

Type N, 10 Watts


Model 1418

Model 1419

EXPRESS

- * dc to 18.0 GHz
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL	
	1418	1419
dc - 4	1.15	1.20
4 - 8	1.20	1.20
8 - 12.4	1.25	1.30
12.4 - 18	1.40	1.35

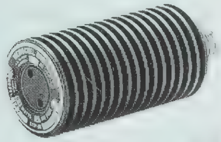
Power Rating:

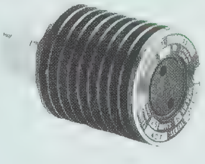
10 W average, 1 kW peak

Dimensions:

Model 1418	2.00" long (MAX)
Model 1419	1.60" long (MAX)

Type N, 25/50 Watts


Model 1426
EXPRESS


Model 1427

- * Choice of Frequency Range:

Model 1426	dc to 8.0 GHz
Model 1427	dc to 10.0 GHz

- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL	
	1426	1427
dc - 4	1.20	1.10
4 - 8/10	1.30	1.15

Power Rating:

Model 1426	50 W average, 5 kW peak
Model 1427	25 W average, 5 kW peak

Dimensions:

Model 1426	3.94" long (MAX)
Model 1427	2.65" long (MAX)

Type N, 25/50/100 Watts

Model 1429

Model 1430

Model 1431

- * dc to 18.0 GHz
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

1.15 - 1.30 (varies with freq)

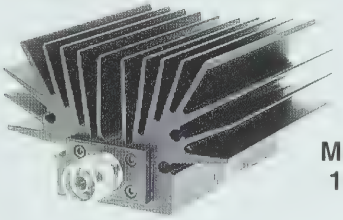
Power Rating:

Model 1429	25 W average, 1 kW peak
Model 1430	50 W average, 1 kW peak
Model 1431	100 W average, 1 KW peak

Dimensions:

Model 1429	2.89" long (MAX)
Model 1430	5.19" long (MAX)
Model 1431	9.69" long (MAX)

Type N, 150 Watts


Model 1432

- * dc to 8.5 GHz
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR:

FREQ (GHz)	MODEL 1432
dc - 4	1.20
4 - 8.5	1.30

Power Rating:

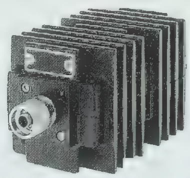
150 W average, 5 kW peak

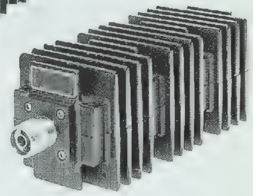
Dimensions:

6.30'" long 5.0" wide 3.0" high (MAX)

Contains four 6-32 UNC-2B X 3/8" deep mounting holes located on bottom of unit.

Type N, 150/250 Watts


Model 1435

Model 1433


- * dc to 5.0 GHz
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR: 1.10

Power Rating:

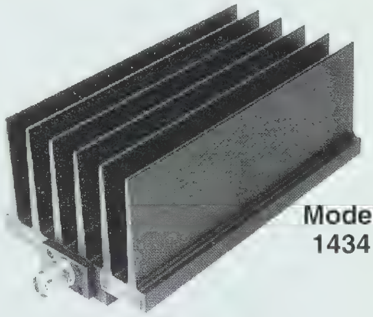
Model 1435	150 W average, 10 kW peak
Model 1433	250 W average, 10 kW peak

Dimensions:

Models	1435	6.30'" long 3.06" wide (MAX)
Model	1433	8.70" long 3.06" wide (MAX)

All models contain four 6-32 UNC-2B (thru 1st fin) mounting holes on each end.

Type N, 500 Watts


Model 1434

- * dc to 8.5 GHz
- * Male/Female connector options

SPECIFICATIONS:

MAX SWR: 1.10

Power Rating:

500 W average, 10 kW peak

Dimensions:

11.1" long 5.5" wide 4.3" high (MAX)

Contains four 6-32 UNC-2B X 3/8" deep mounting holes located on bottom of unit.

POWER SPLITTERS & DIVIDERS

Power Splitters

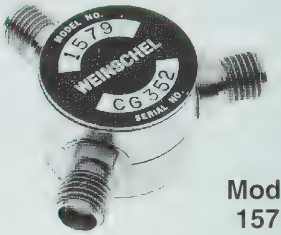
These resistive power splitters are intended for applications in which one of two outputs are included in a leveling loop or used as a reference in a ratio system, for the purpose of providing an output signal whose source impedance is essentially matched to 50 ohms. Other features include:

- Miniature size and lightweight
- Accurate division of outputs
- Test data supplied
- Connector options available

Model 1870A

EXPRESS

Model 1872A not shown.



Model 1579

SPECIFICATIONS:

MODEL NO.	FREQUENCY RANGE (GHz)	MAX INPUT POWER CW(W)	INSERTION LOSS (MAX dB)	SWR[1] (f MAX)	CONNECTOR TYPE
1579	dc-26.5	0.5	8.5	1.25-1.35[2]	SMA (F) ALL PORTS
● 1870A	dc-18	1	7.5	1.05-1.15[2]	Type N (F) ALL PORTS
1872A	dc-18	1	7.5	1.05-1.15[2]	Type N (F) in 7mm out

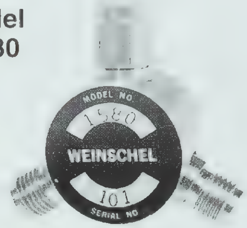
● *EXPRESS* SHIPMENT AVAILABLE

[1] EQUIVALENT SOURCE SWR
[2] VARIES WITH FREQUENCY

Power Dividers

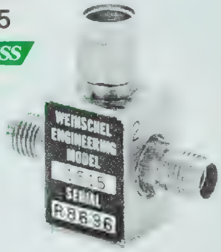
- Miniature size and lightweight
- Excellent phase and amplitude tracking
- Test data supplied
- Connector options available

Model 1580



Model 1515

EXPRESS



SPECIFICATIONS:

MODEL NO.	FREQUENCY RANGE (GHz)	MAX INPUT POWER CW (W)	INSERTION LOSS (MAX dB)	SWR	CONNECTOR TYPE
● 1506A	dc-18	1	7.5	1.25-1.35[1]	Type N (M) IN Type N (F) OUT
● 1515	dc-18	1	7.5	1.25-1.35[1]	SMA (M) IN SMA (F) OUT
1580	dc-26.5	1	8.5	1.25-1.7[1]	SMA (M) IN SMA (F) OUT

● *EXPRESS* SHIPMENT AVAILABLE

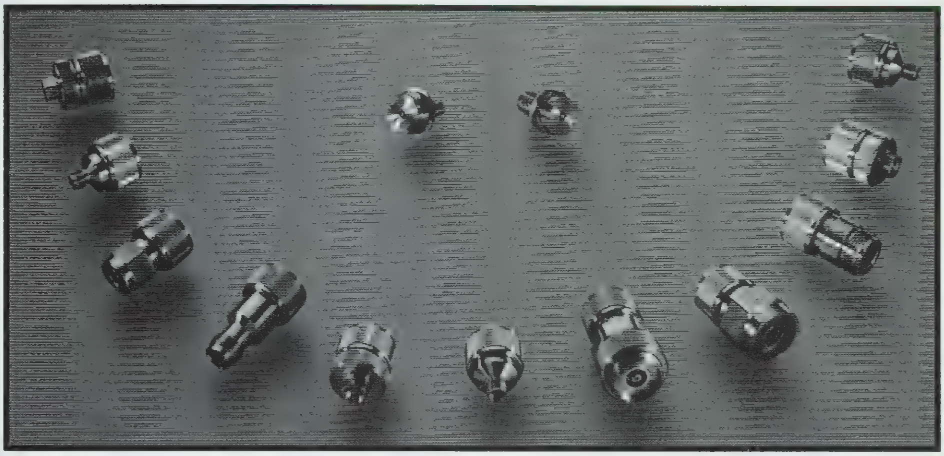
[1] EQUIVALENT SOURCE SWR

Model 1506

EXPRESS

PLANAR CROWN® Connector System

The use of the Lucas Weinschel PLANAR CROWN® connectors can provide the user with easy exchange of connector types, which eliminates the need for adapters and other devices that would create additional insertion loss. This "Torque Free" type of connector also provides quick removal and replacement of defective connectors at minimum cost. Other features include an operating frequency range of dc to 40 GHz with 2.92 mm option; ability to maintain calibration integrity when changing connector types; and compatibility with all Type N, TNC, 7mm, SMA, 3.5 mm, 2.92 mm and 2.4 mm connectors used throughout the microwave industry.

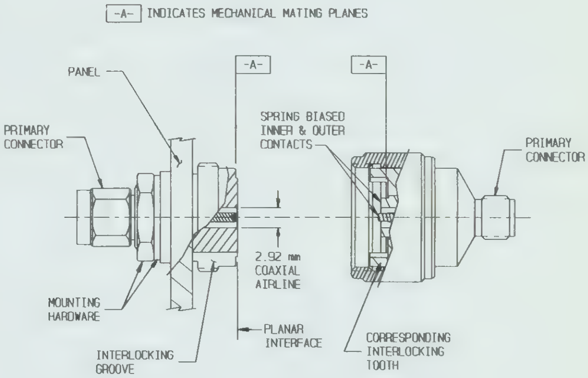


This connector system is ideal for applications where your test port connectors are regularly damaged and require field replacement.

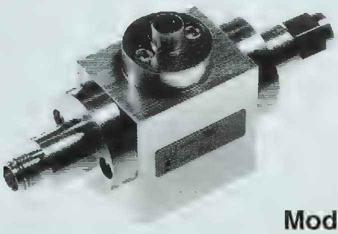
Ordering Guide:

MODEL	FREQUENCY RANGE (GHz)	DESCRIPTION
● 7004A-1	dc-40	SMA Female to Crown Bulkhead
● 7004A-2	dc-40	SMA Male to Crown Bulkhead
● 7005A-1&-2	dc-26.5	Crown to SMA Female/Male
● 7005A-3 &-4	dc-18	Crown to Type N Female/Male
7005A-5	dc-18	Crown to GPC7
7005A-6 &-7	dc-34	Crown to 3.5 mm Female/Male
7005A-8 &-9	dc-18	Crown to TNC Female/Male
7005A-10 & -11	dc-40	Crown to 2.92 mm Female/Male
7005A-12 &-13	dc-40	Crown 2.4 mm Female/Male

● *EXPRESS* SHIPMENT AVAILABLE


-A- INDICATES MECHANICAL MATING PLANES
PANEL
-A-
-A-
PRIMARY CONNECTOR
SPRING BIASED INNER & OUTER CONTACTS
PRIMARY CONNECTOR
2.92 mm COAXIAL AIRLINE
MOUNTING HARDWARE
PLANAR INTERFACE
INTERLOCKING GROOVE
CORRESPONDING INTERLOCKING TOOTH

Phase Shifters



Model 7007

- * dc to 18/20 GHz
- * Ruggedized SMA/2.92 mm connectors
- * Male/Female Connector options
- * Rugged Construction
- * Linear

SPECIFICATIONS:

INCREMENTAL PHASE SHIFT:

Model 917:	Adjustable to 225° @ 20 GHz; 100° at 9 GHz.
Model 7007:	Adjustable to 200° @ 18 GHz; 100° at 9 GHz.

RESOLUTION:

0.5° per turn per GHz, typical (Adjustment shaft has 20 turns for full range).

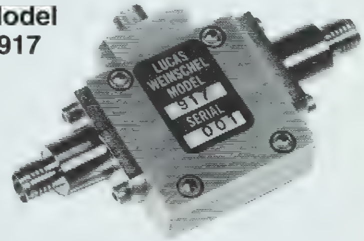
INSERTION PHASE:

Model 917:	890° @ 10 GHz (Typical)
Model 7007:	1600° @ 18 GHz (Typical)

PHASE vs FREQUENCY:

Nominally linear response

Model 917


LUCAS WEINSCHEL
MODEL
917
SERIAL
001

INSERTION LOSS:

Model 917:	0.8 dB maximum (0.5 dB typical @ 20 GHz)
Model 7007:	1.0 dB maximum (0.5 dB typical @ 18 GHz)

MAXIMUM SWR: 1.5

POWER RATING: 200 watts average

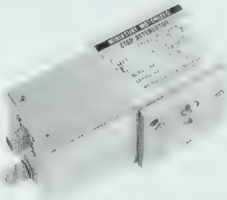
OTHER ATTENUATORS/COMPONENTS

Manual Step Attenuators

Lucas Weinschel offers several Models that will meet a wide range of customer needs such as:

* Choice of attenuation ranges and incremental steps
* Operating frequency ranges up to 26.5 GHz
* Special configurations and connector options available
* Excellent repeatability
* A variety of standard models with different mounting configurations.

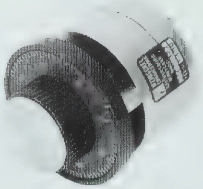
Motorized Step Attenuators



This line of broadband motorized step attenuators has been designed to meet a wide range of system and user requirements. Lucas Weinschel offers a variety of models which include:

* Choice of attenuation ranges and incremental steps
* Operating frequency ranges up to 40 GHz
* Self-contained control circuitry
* 3.5 mm\2.92 mm connectors
* Excellent repeatability and long switch life (over 1 million)

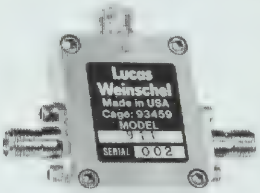
Continuously Variable Attenuators



This line of Continuously Variable Attenuators offers a unique combination of low insertion loss (Model 910), broadband uniform characteristics, and phase shift of an RF signal similar to that of a transmission line—all in an environmentally tested package. Other features include:

* Several standard models to choose from
* Choice of attenuation ranges up to 127 dB.
* Operating frequency ranges up to 4.2 GHz
* Special configurations and connector options available
* Excellent phase characteristics
* Power input capabilities up to 5 W
* Easily mounts to any instrument panel

Level Set Attenuators



Lucas Weinschel offers several Models of Level Set Attenuators which operate in the 8.0 to 26.5 frequency range and provide an adjustable attenuation range from 0 to 25 dB. Other features include:

* Easy adjustment
* Compact size
* Very low insertion loss
* Self locking mechanisms
* Low cost

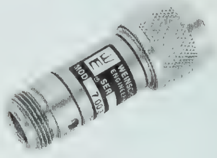
Programmable Step Attenuators

Lucas Weinschel
PROGRAMMABLE
ATTENUATOR

Lucas Weinschel offers one of the largest lines of programmable step attenuators available. Our attenuator design is a result of an extensive development program to ensure that every attenuator offers long reliable operation with exceptional accuracy. Standard attenuation ranges up to 127 dB are available in incremental steps of 1, 5, or 10 dB. Custom configurations with a variety of incremental steps and attenuation ranges are also available. Other features include:

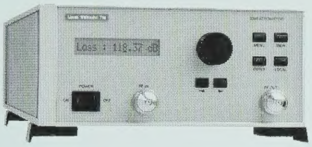
* Choice of attenuation ranges and incremental steps
* Operating frequency ranges up to 26.5 GHz
* Ruggedized SMA/3.5 mm connectors
* Latching and non-latching models
* Excellent repeatability and long switch life (5-10 million)
* Switching times from 1.5 to 20 milliseconds

DC Blocks



* 10 kHz to 18 GHz
* Different connector types (N/SMA/Planar)
* Rugged construction
* Low SWR & Insertion Loss

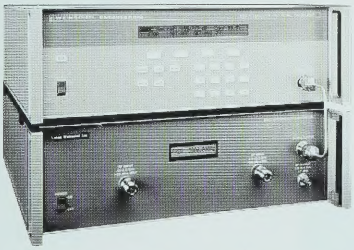
Model 8300 Attenuator



This new versatile Programmable Attenuator can be widely used in ATE systems, calibration/engineering labs or even production testing and QA inspection setups. Other features include:

* Enhanced user interface.
* Ability to store approximately 16,000 calibrations.
* Displays both nominal and calibrated attenuation, not just individual attenuator cell values.
* IEEE-488 programmability.
* Non-volatile memory provides storage of calibration frequencies, the characteristic zero insertion loss, and the attenuation data for each cell combination.
* Choice of frequency ranges up to 26.5 GHz and attenuation ranges from 0 to 127 in 1 dB steps.

Model 8850, Attenuation Measurement System



Lucas Weinschel now offers a state-of-the-art .01 to 18 GHz attenuation measurement system. This has been achieved by combining the accuracy, high sensitivity performance and reliability of our Model VM-7 (30 MHz receiver) with our new Model 8852, 0.01 to 18 GHz Frequency Converter. The Model 8852 performs the necessary RF to IF conversion to 30 MHz IF, which then can be measured by the VM-7. Some other features of this system include:

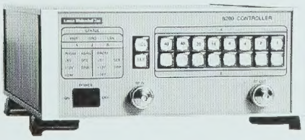
* Full IEEE-488 Programmability.
* Accuracy of 0.005 dB/10 dB.
* Input sensitivity is -117 dB min.
* An auxiliary output of 2 to 18 GHz synthesized in 2 KHz steps at 7 dBm for driving other devices.
* Extendable to 40 GHz in coax using Lucas Weinschel Model 8853.

System IIA, Automatic Power Meter Calibration System

The System IIA is an IEEE-488 bus controllable system designed to calibrate power meter sensors over the 0.01 to 18.0 GHz frequency range. System IIA provides accurate measurements for standard calibration points which are directly traceable to the National Institute of Standards and Technology). Other System IIA features include:

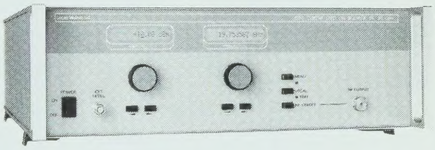
* Accuracies < 1% (RSS) above that provided directly by NIST.
* Expandable up to 40 GHz and down to 100 KHz.
* Total system accuracy for the transfer of calibration factors 1.2% to 2.5% (RSS) from 0.01-18 GHz.
* 5 seconds/measurement includes signal averaging and meter settling time.
* Test Ports - N male/female or GPC7
* Substituted power levels 0.5 mW and 1.0 to 10 mW in 1 mW steps ± 0.1% + 1 µW.
* Calibration factor transfer repeatability 0.1%.

Model 8200 Controller



The Lucas Weinschel Model 8200 is capable of driving/controlling a variety of programmable attenuators, relays, electromechanical switches, or TTL compatible devices that operate at +5, +12, or +24 V via either front panel or IEEE-488 GPIB operation. The devices can be either internally mounted, external, or a combination of both.

Models 4380 & 4381 Synthesized CW Signal Sources



The Lucas Weinschel Model 4380 and Model 4381 are the result of over 35 years experience in the design and manufacture of RF and microwave signal sources and sweepers. These new Synthesized Signal Sources fill the need for a low cost source of stable CW power. Whether the need is for production test or calibration laboratory, the combination of low phase noise and +10 dBm levelled output over the entire band is hard to beat. Couple this with 1 KHz resolution, internal and external levelling, manual or remote IEEE-488 bus operation and you have all the elements necessary for most manual or ATE measurement systems.

Why pay for functions that don't contribute to performance in dedicated applications? Focusing the design effort on CW operation only has yielded a lower cost instrument well suited to measurement systems in calibration laboratories, on the production floor, and in other application specific areas. Models 4380 and 4381 provide users with many benefits such as:

* Designed for compatibility with all Lucas Weinschel measurement systems.
* Full IEEE-488 Programmability.
* 10 MHz Reference Signal.
* PLANAR CROWN® Connector System.

Lucas Aerospace

Lucas Weinschel, A Division of Lucas
Aerospace Communications & Electronics, Inc.
P.O. Box 6001, Gaithersburg, MD 20884-6001
301-948-3434 • 800-542-4457 • 800-638-2048
FAX: 301-948-3625

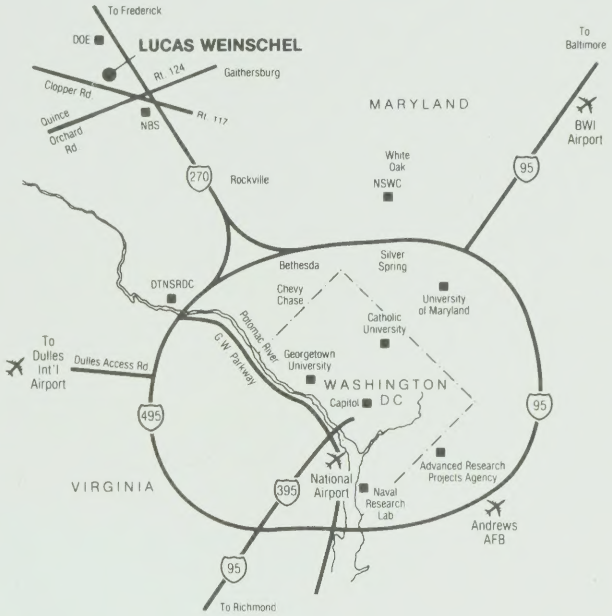
Visiting Lucas Weinschel

Lucas Weinschel is located in Gaithersburg, Maryland, approximately 30 miles north of Washington, DC. The area is served by three major airports with car rental available at each. Also, airport limousine service is available to all Gaithersburg hotels, most of which are less than one mile from Lucas Weinschel. Many of our visitors avail themselves of this service to avoid the hassle of driving in an unfamiliar location.

FROM DULLES AIRPORT: Dulles access to 495, North on 495. Take 270 toward Frederick to Rte. 117 West (Clopper Road). Travel west on Clopper Road (through 4 traffic lights) to One Weinschel Lane on right.

FROM WASHINGTON NATIONAL AIRPORT: Take George Washington Memorial Parkway North to 495. Take 495 toward Maryland, then same as above.

FROM BWI AIRPORT: Follow signs to 95 South to 495 (West toward Silver Spring) to Rte. 270. North toward Frederick, then same as above.


To Frederick
DOE
LUCAS WEINSCHEL
Rt. 124
Gaithersburg
Clopper Rd
Quince Orchard Rd
NBS
Rt. 117
270
Rockville
MARYLAND
To Baltimore
BWI Airport
White Oak NSWC
95
Bethesda
Silver Spring
DTNSRDC
Chevy Chase
University of Maryland
Catholic University
Potomac River
G.W. Parkway
To Dulles Int'l Airport
Dulles Access Rd
Georgetown University
WASHINGTON DC
Capitol
495
95
VIRGINIA
395
National Airport
Naval Research Lab
Advanced Research Projects Agency
Andrews AFB
95
To Richmond

HOLIDAY INN

2 Montgomery Village Avenue
Gaithersburg, MD 20878
(301) 948-8900

RED ROOF INN

497 Quince Orchard Road
Gaithersburg, MD 20878
(301) 977-3311

MARRIOTT HOTEL

620 Lakeforest Boulevard
Gaithersburg, MD 20878
(301) 977-8900

ECONO LODGE

18715 North Frederick Avenue
Gaithersburg, MD 20879
(301) 963-3840

COURTYARD
by Marriott

805 Russell Avenue
Gaithersburg, MD 20879
(301-670-0008)

Lucas Weinschel Warranty

PRODUCTS-

Lucas Weinschel warrants each product it manufactures to be free from defects in material and workmanship under normal use and service anywhere in the world. Lucas Weinschel's only obligation under this Warranty is to repair or replace, at its plant, any product or part thereof that is returned with transportation charges prepaid to Lucas Weinschel by the original purchaser within ONE YEAR from the date of shipment.

The foregoing Warranty does not apply to, and in Lucas Weinschel's sole opinion, products that have been subject to improper or inadequate maintenance, unauthorized modifications, misuse, or operation outside the environmental specifications for the product.

SOFTWARE PRODUCTS-

Lucas Weinschel software products are supplied without representation or Warranty of any kind. Lucas Weinschel, therefore, assumes no responsibility and will not accept liability (consequential or otherwise) arising from the use of program materials, disc, or tape.

The Warranty period is controlled by the Warranty document furnished with each product and begins on the date of shipment. All Warranty returns must be authorized by Lucas Weinschel prior to their return.

Lucas Aerospace

Lucas Weinschel, a division of
Lucas Aerospace Communications & Electronics Inc

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TLX: 440702